HEATING AND VENTILATING

FEBRUARY 1930

You Can't Buy More

There can be so much quality to a thing and no more. We firmly believe that no other radiator trap can compare with the Sarco in performance and endurance. Here are some of the Sarco features that mean satisfactory service for your clients—features that you are safe to endorse.

Sarco Radiator Traps have a heavy wall helical bellows and have more convolutions than required to withstand the stresses encountered. The corrugations are in a continuous spiral, insuring even distribution of the movement and eliminating "wear spots." Longer life is the result.

Sarco's discharge opening is large and its lift high, giving it great capacity.

Line contact only is had between cone tip and seat of valve, making it practically impossible for scale or dirt to collect.

The expansion element of type E Sarco Trap is not attached to the cap but is held rigidly in place without springs. That simplifies installation and makes parts interchangeable even by unskilled labor.

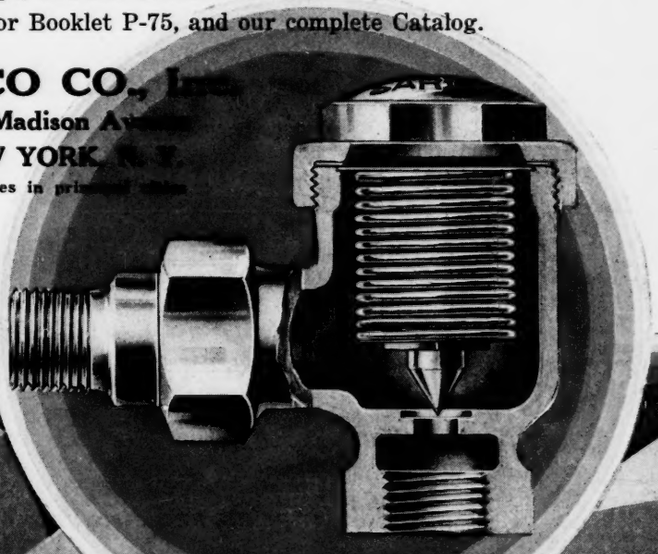
These traps cannot air bind, water hammer or freeze.

The body is heavy bronze, heavily nickeled—a strong and handsome device.

Complete equipment for heating systems furnished, including Inlet Valves, Thermostatic Return Traps, Drip Traps, Combination Float and Thermostatic Traps, and Air Eliminators.

Write for Booklet P-75, and our complete Catalog.

SARCO CO., Inc.
183 Madison Avenue
NEW YORK, N. Y.
Branches in principal cities

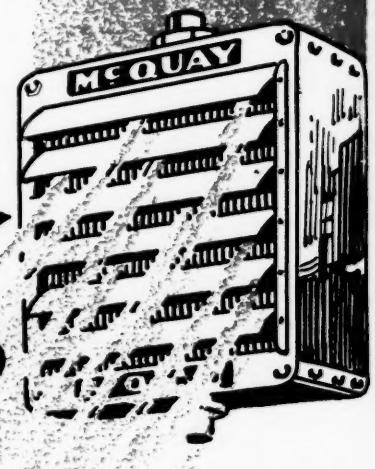


SARCO RADIATOR TRAP

Heat the Lower Third

—every workman will be comfortable and a lot of fuel will be saved

Heating the upper parts of a factory is just a waste of good fuel. It's the lower third — *down where the workmen are* — that needs the heat. Yet with old-time methods most of the heat goes up towards the roof. Heating costs run wild, and men are uncomfortable — a few of them too hot, most of them too cold to work.



McQUAY UNIT HEATERS

Force the heated air down into the working areas. Very little of it is wasted. **The result is far smaller fuel bills, and everyone is comfortable.**

The "cold spots" that often make good floor space useless disappear entirely. And the heaters are up off the floor, out of the way.

Built in capacities equal to from 50 to 2000 square feet of cast-iron radiation, there is a McQuay Unit Heater for every purpose. The installation of one or two McQuay Units often provides sufficient heat in inadequately heated factories.

Ask for prices and discounts. McQuay Products are sold only through recognized heating contractors.

McQUAY RADIATOR CORPORATION

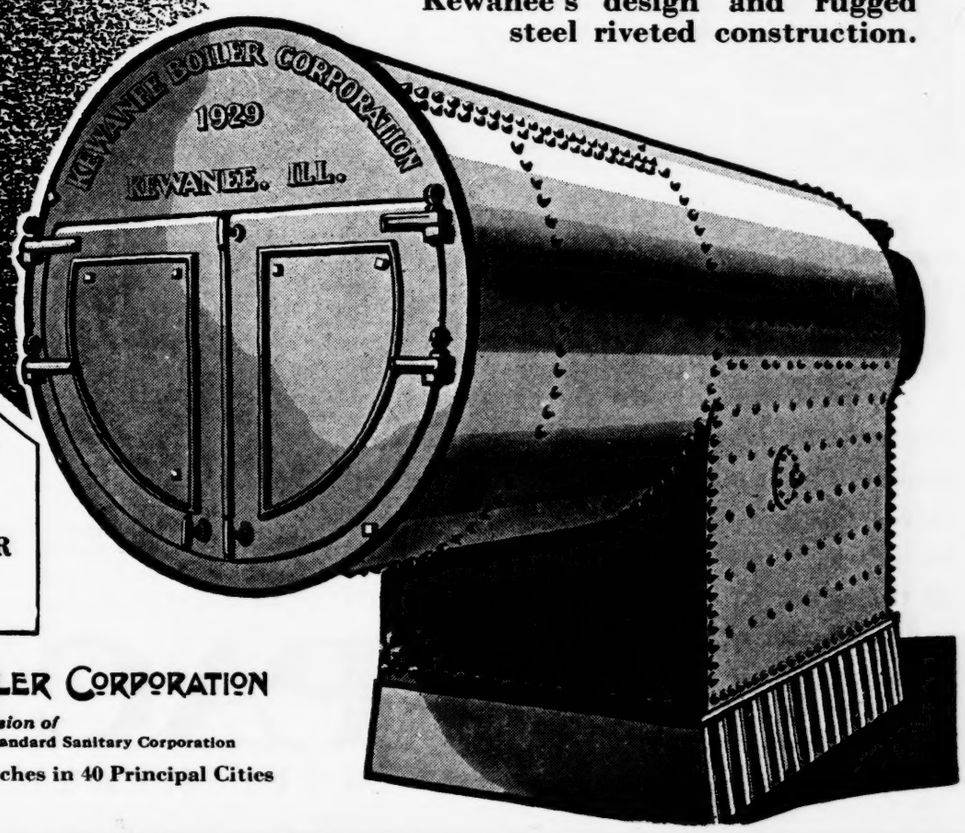
General Offices:
35 East Wacker Drive
Chicago

KEWANEE STEEL RIVETED BOILERS

Equally Efficient with Coal *or* Oil

Oil makes a quick hot fire—so the boiler must have a *large water content* to absorb the heat: The firebox must be *high* to provide plenty of space for the oil and air to mix: And great strength is needed because of the sudden temperature changes caused by an oil fire.

Each one of these requirements, as well as many others, is ideally answered by Kewanee's design and rugged steel riveted construction.

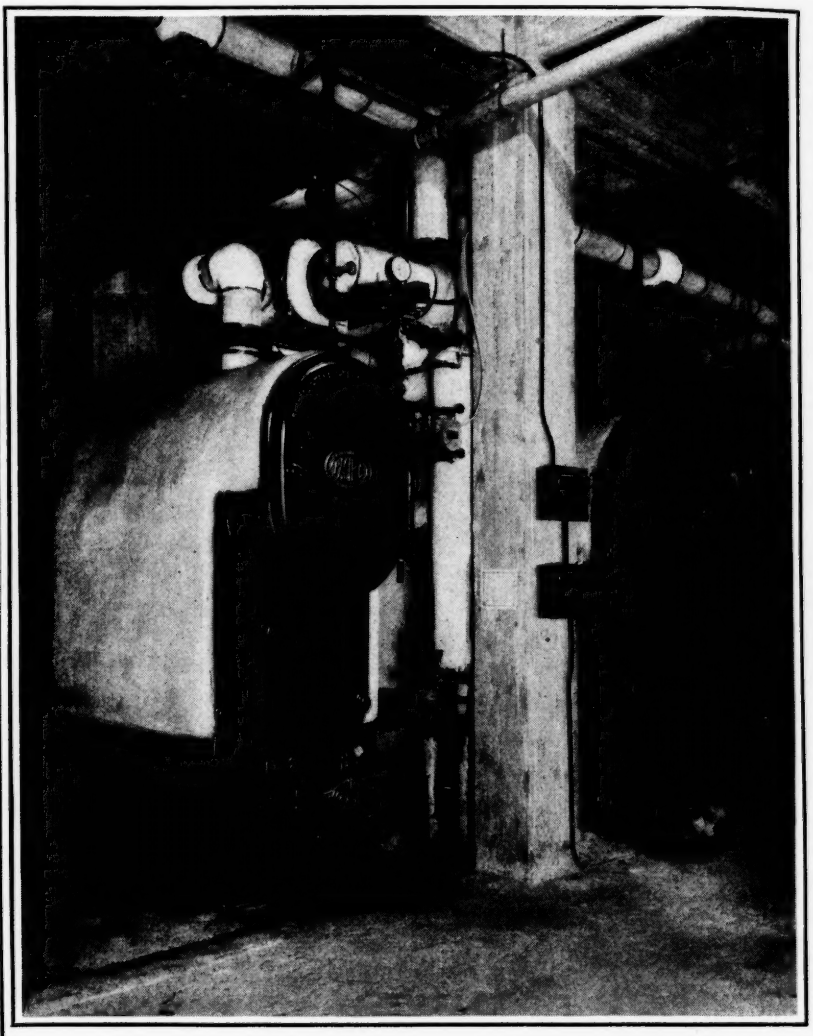


Ask about the
NEW
KEWANEE
STEEL BOILER
for
HOMES AND SMALLER BUILDINGS
Catalog 88 gives details

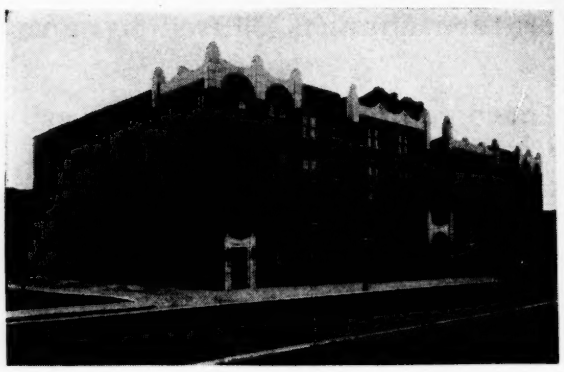
KEWANEE BOILER CORPORATION
division of
American Radiator and Standard Sanitary Corporation
Kewanee, Ill. Branches in 40 Principal Cities

HEATING AND VENTILATING, *formerly* THE HEATING AND VENTILATING MAGAZINE, published by NATIONAL BUILDING PUBLICATIONS, Division of NATIONAL TRADE JOURNALS, INC., at 521 Fifth Ave., New York, N. Y. Subscription rates: United States, $2.00; Canada, $2.50; Foreign, $3.00. Single Copies, 30 cents. Vol. XXVII, No. 2, February, 1930. Entered as second-class matter, April 18, 1925, at the Post-Office at New York, N. Y., under the Act of March 3, 1879. Copyright, 1930, by NATIONAL TRADE JOURNALS, INC.

Steel Heating Boilers and Capitol Radiators make a Logical Combination



Pacific Steel Boilers in the Conlyn Towers Apartment, Philadelphia. When negligence put the 18000 ft. boiler out of commission, the 4200 ft. boiler used for summer hot water supply kept the building warm.



FOOL PROOF CONSTRUCTION

It happened in the Conlyn Towers apartment, Philadelphia, where an 8601 (18,000 ft.) Pacific Steel Boiler was recently installed.

The system was being cleaned by discharging all condensation into the sewer and supplying make-up water with a water feeder. A negligent building attendant shut off the feed valve. The low water cut-off switch on the boiler was not yet connected. Consequently, all the water in the system was evaporated and the boiler heated to a cherry red, remaining so for some time.

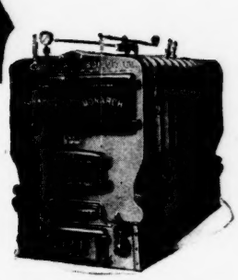
"When first notified," Edward R. Sabin Company, heating contractors wrote, "we assumed the boiler would be damaged beyond repair but were agreeably surprised when the boiler was put in operation again inside of 24 hours, having found it only necessary to re-roll the tubes . . . This incident more than convinced us of the ruggedness of your welded construction."

PACIFIC STEEL BOILER CORPORATION
General Offices: Detroit, Michigan
Factories: Waukegan, Ill., Bristol, Pa.
Sales Offices in 58 Cities
Division of United States Radiator Corp., Detroit, Michigan

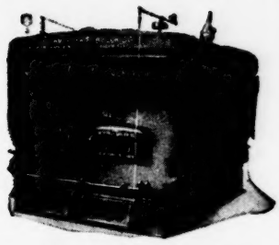
PACIFIC
STEEL HEATING BOILERS

1930 Now,

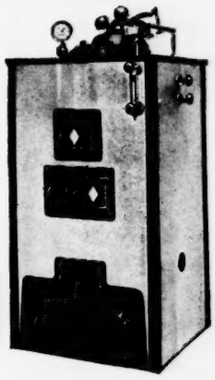
Volunteer Boiler



Monarch 40" Boiler



Monarch 60" Boiler



Red Diamond Boiler

is the time to change to Page

Page Boilers have held the complete confidence and respect of leading heating engineers and contractors for three quarters of a century, because they are—a truly superior line of boilers.

With deep combustion chamber and long triple level fire travel, Page Boilers lend themselves perfectly to the high combustion of gas or oil, and are most economical in fuel consumption when burning hard or soft coal, of any size and grade obtainable.

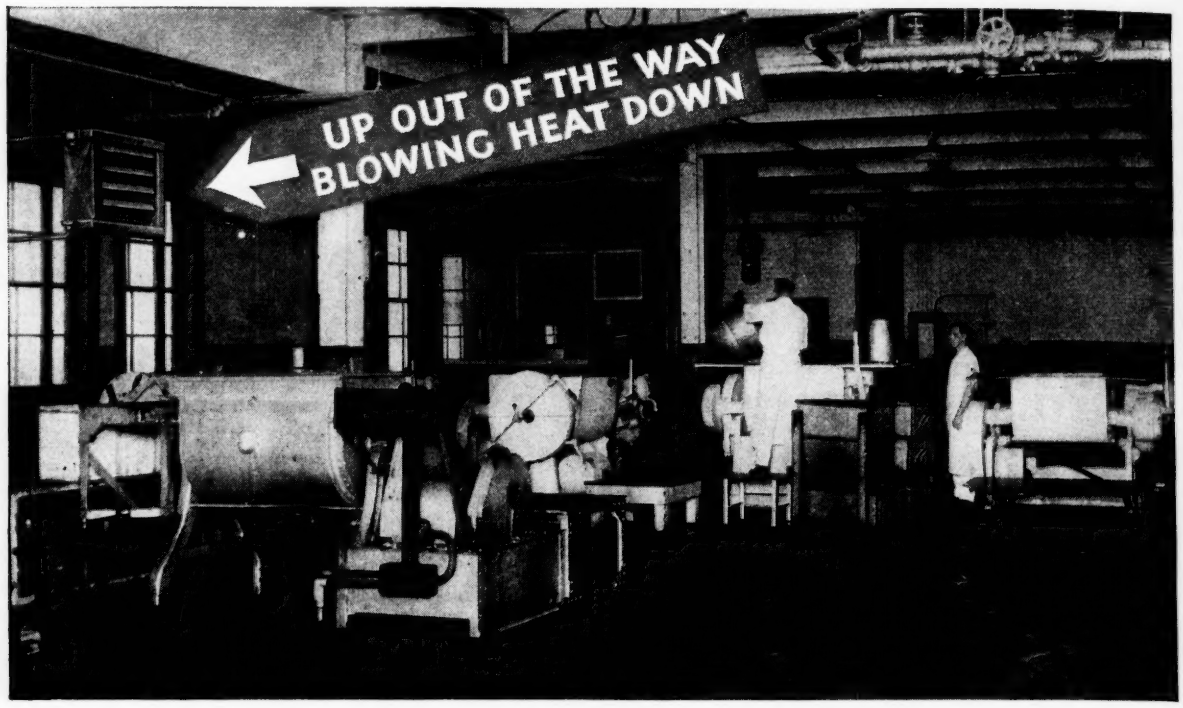
And the price is moderate. Write for catalog.

The Wm H Page Boiler Co

Branch Offices and Warehouses:
Boston, 123 Beverly Street
Philadelphia, 1126 Washington Ave.
Cleveland, 5 Villa Beach, Lake Shore Blvd.
Factory: Meadville, Pa.

200 Madison Avenue, New York

Dig up the facts and you too will recommend Page Boilers



YOUR SYSTEM *only* when you

If a heating system is right no one is ever conscious that there is a heating system. Grinnell Thermoliers keep the temperature as you want it, automatically controlled. They diffuse warmth from above.

THERMOLIER unit heaters give constant, *even* heat without underheating inefficiency; without overheating waste.

Cold Spots Made Warm

Grinnell Thermoliers permit modernizing an obsolete heating system almost over night. Or a single Thermolier eliminates cold spots that your present heating system

GRINNELL COMPANY

Executive Office: Providence, R. I.

Branches in all Principal Cities

HEAT WITH
UNIT HEATERS

Thermolier

Made in eight models to fit any space and every condition.

HEATING IS RIGHT- don't notice it

can't reach. Its stream of *live* air breaks up pockets of dead air. This fan-driven warmth vitalizes the atmosphere without causing unpleasant drafts or dangerous extremes of heat and cold.

10,000 Units In Use

Some 10,000 Thermoliers are in active use in a great variety of occupancies. Our heating experts have doubtless already solved conditions paralleling yours. Why not get their advice, or write for the booklet on heating called "Fourteen Points of Superiority?" There is no obligation on your part. The coupon is for your convenience.

14 Points of Superiority

GRINNELL COMPANY, INC.
208 W. Exchange St., Providence, R. I.

I want to read more facts about the Thermolier. Send along the booklet.

Name .....

Title .....

Firm Name .....

Address .....

SPECIALIZED BOILER DESIGN Brings Economy to Oil-Heating

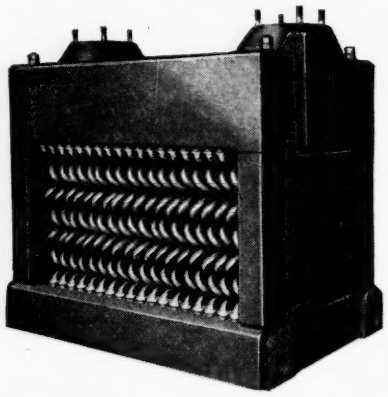
OIL-BURNERS produce *more* heat, in *less* time, than a coal fire. Obviously, an efficient oil-burning boiler *must* be capable of absorbing more heat in less time than a coal-burning type of boiler.

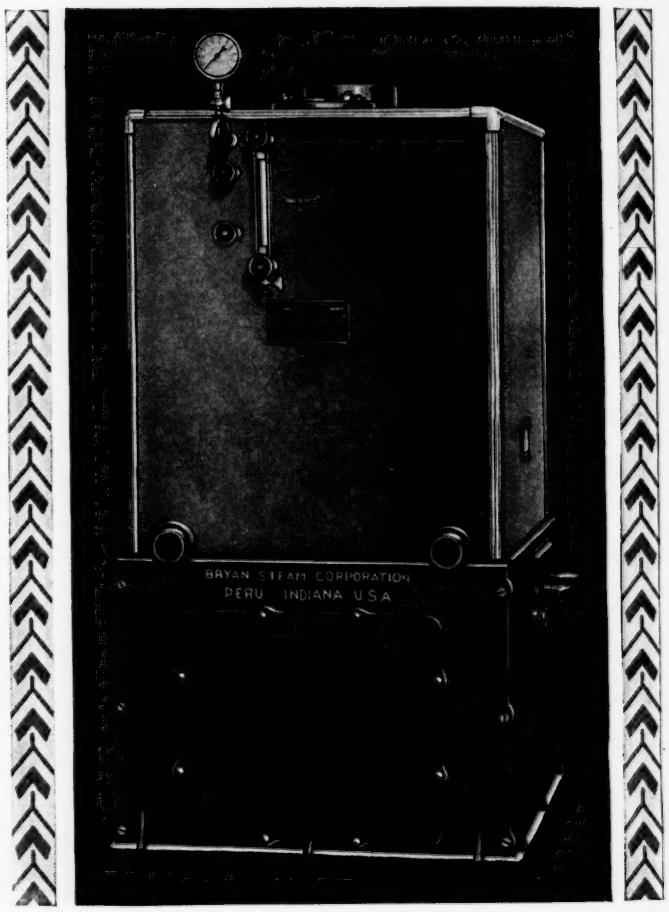
The Bryan Copper-Tube Boiler has been built from the very beginning to absorb heat just as fast as the oil-burner produces it—and it does this, exactly. As a result, Bryan Boilers, both in laboratory tests and in actual service, are consistently showing a fuel saving of from 30% to 50% over other types of boilers.

How Bryan has obtained this result through the use of copper-tubes, the elimination of long flues—in short, by the development of an entirely new type of boiler—is completely told in the new Bryan Catalog.

Write for this catalog. It tells simply and clearly why the Bryan is a better, more efficient and more economical boiler for every home-owner who desires the convenience and satisfaction of automatic heat. We shall be glad to send you the catalog, with full information on the Bryan proposition.

BRYAN STEAM CORPORATION
(*Boiler Division*)
PERU, INDIANA

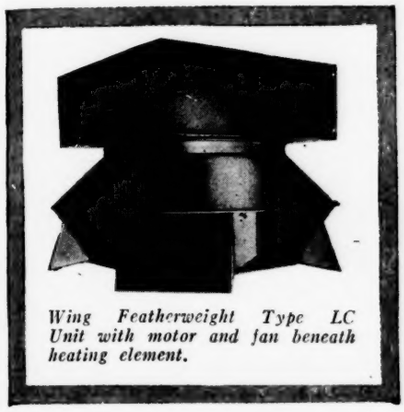




(LEFT)—THE COPPER-TUCE ASSEMBLY—*Contrast this maze of copper-tubes through which every heat unit must pass in the Bryan Boiler, with the bulky, heavy cast-iron sections of the conventional coal-burning type of boiler. With Bryan there is no "laning" or stratification of the hot gases. The heat is broken up, time after time, by rushing head-on into the copper-tubes, which are capable of absorbing and transmitting heat more than seven times as fast as a cast-iron section of equal size.*

BRYAN Copper-Tube BOILERS

WING FEATHERWEIGHT



Wing Featherweight Type LC Unit with motor and fan beneath heating element.

LOGICAL HEATING

Heaters Located Overhead Spreading Warmed Air Downward in All Directions

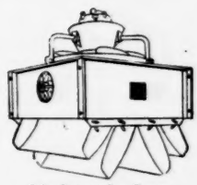
for Every Type of Industrial Building

Wing Featherweight Type HC Unit. Below are shown a variety of discharges designed for this type.

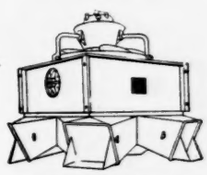
WING Featherweight Unit Heaters are the logical heaters for all industrial buildings because they counteract the wasteful banking up of hot air under the roof or ceiling. They are placed as high as possible *directly* overhead, where they draw in the already warmed air from these upper spaces, reheat it and discharge it vertically downward, keeping all heat in circulation and directing it to the working level FIRST. This prevents the usual waste in heating high roofed industrial buildings. So evenly is the building heated as a result, that temperature varies only a fraction of a degree per foot height in a Wing heated building.

Write for our catalog — a study of the many installations illustrated will interest you

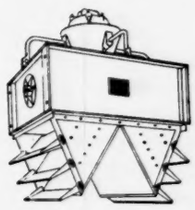
Moderate Heights— square areas



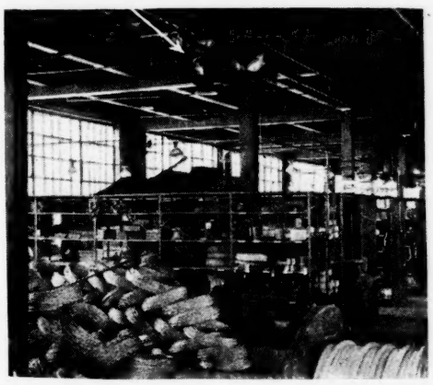
Moderately Low— long narrow areas



Low Positions— square areas



Low—Long narrow areas



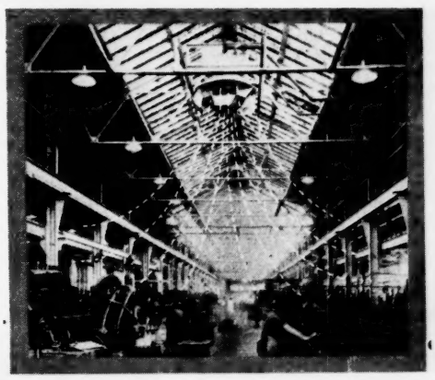
L. J. WING MFG. COMPANY

Dept. 2

158 W. 14th Street

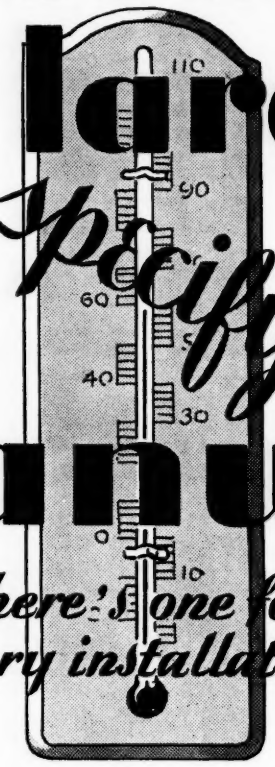
New York, N. Y.

"Heat with Unit Heaters"



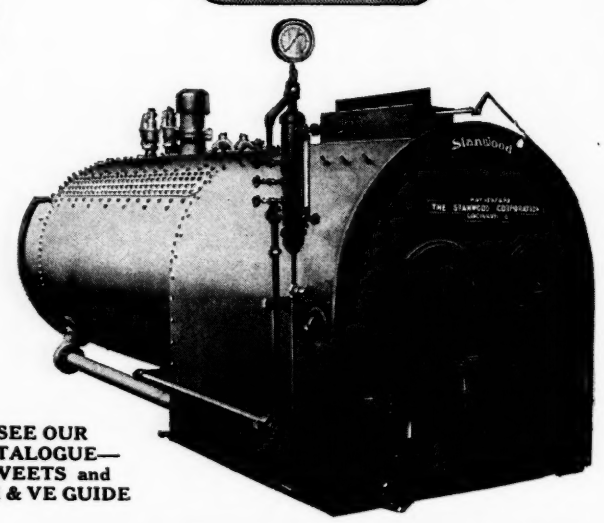
UNIT HEATERS

Whether it's small or large specify a Stanwood



there's one for every installation

TO specify boilers because of preference for any single feature alone is to risk the antagonism, ill-will, and unfriendliness of clients. Studying facts and delving thoroughly into the complete design is the only safe basis on which to predetermine boiler performance. Existing conditions must be met — individual circumstances overcome — client's wishes regarded — operating economy proven—important advantages considered — these and other factors help to determine the choice made by owner, architect, and heating contractor.



SEE OUR CATALOGUE— SWEETS and ASH & VE GUIDE

In this respect Stanwood Boilers have long been the satisfactory choice of all three. Exceptional and meritorious features of design have emphatically proven the Stanwood's superiority in both large and small installations. Long-time Stanwood service and remarkable efficiency are creating economies of operation that are sure to interest every engineer and contractor in the country.

If you are specifying boiler equipment now, no matter what type it may be, large or small —you should have the facts about Stanwood Boilers.

STEEL RIVETED CONSTRUCTION

Four distinct advantages—distinct because they do not appear in any other boiler—mark Stanwood's superiority and are responsible for the continued popularity that this boiler has enjoyed. The extremely low water line permits installation where head room is limited or excavation undesirable. Design permits very easy cleaning. Special design gives unequalled, rapid water circulation. Absence of waterlegs eliminates place for sediment, silt, and dirt to collect, speeding up water circulation.

Stanwood economy alone will warrant sending the coupon.

Mail Now!

THE STANWOOD CORPORATION,
Dept. D-230, Cincinnati, Ohio.
Gentlemen:

Kindly send me details on the Stanwood Boiler for

.....working pressure.....horsepower.

Name.....

Address.....

City.....State.....

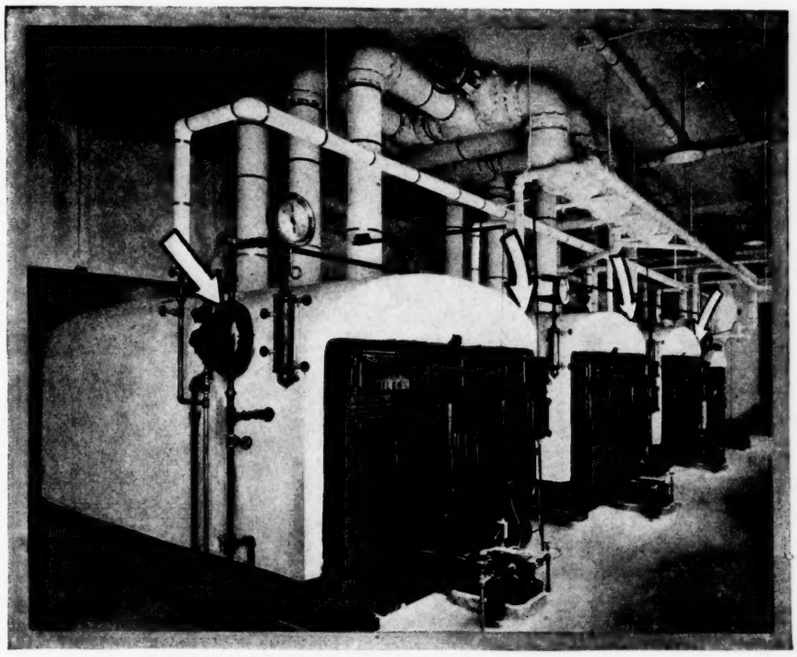
☐ Self-contained Stanwood ☐ HRT

Stanwood Smokeless Boilers

The Stanwood Corporation

CINCINNATI *Established 1891* OHIO

Manufacturers also of Horizontal Return Tubular Boilers, Stacks, Breechings, Tanks, Throttling and Automatic Steam Engines.



Bassick High School, Bridgeport, Conn., four H. B. Smith No. 60 Boilers protected by four McDonnell & Miller No. 28 Feeders installed by W. P. Kirk Co., Bridgeport, Conn.

Memory's Successor

There is no way out after the boiler water level is forgotten and the damage is done. But there's a way *around* before it happens—the McDonnell & Miller way. Why not entrust the vital job, of keeping the boiler water line where it belongs, to this dependable device whose memory cannot fail?

There is now a McDonnell & Miller Boiler Feeder for every type and size of steam, vapor or vacuum boiler—the time-tested No. 28 Self-Cleaning Duplex Feeder for medium and large boilers—the No. 29 Feeder for process boilers—and that new addition to the McDonnell & Miller line, the McDonnell No. 30 Safety Feeder, designed particularly for smaller jobs where price is a factor.

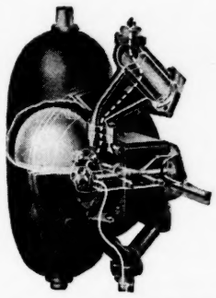
Particularly for the oil-fired job, a dependable boiler feeder is nothing short of a necessity, and with the McDonnell & Miller line now broadened to cover every requirement of every type of low pressure boiler, there is no longer any excuse for *any* installation being unprotected.

A new bulletin covers the triumvirate of McDonnell & Miller Feeders. Use the coupon to request your copy.

McDONNELL & MILLER
1314 WRIGLEY BUILDING CHICAGO
Eastern Office: Grand Central Terminal, New York, N.Y.

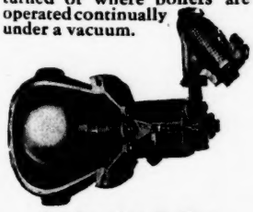
McDONNELL & MILLER
1314 WRIGLEY BLDG., CHICAGO
Please send bulletin covering the full line of McDonnell & Miller Boiler Feeders.

Business Name.....
Individual.....
Street and No.....
City and State..... HV-1



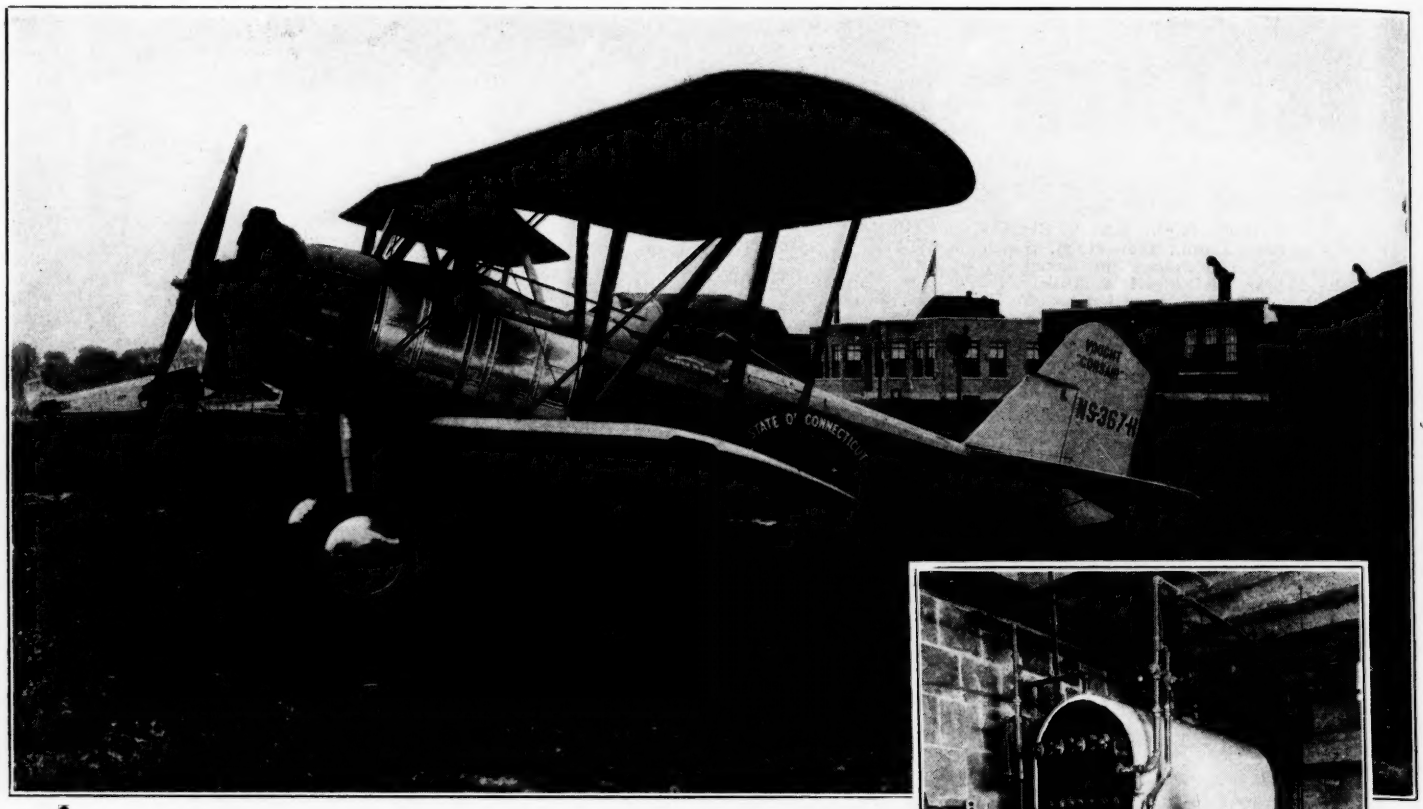
for Medium & Large Boilers
The McDonnell & Miller No. 28
Self-Cleaning Duplex Feeder. The Feeder that set the standard of duplex feeder quality.

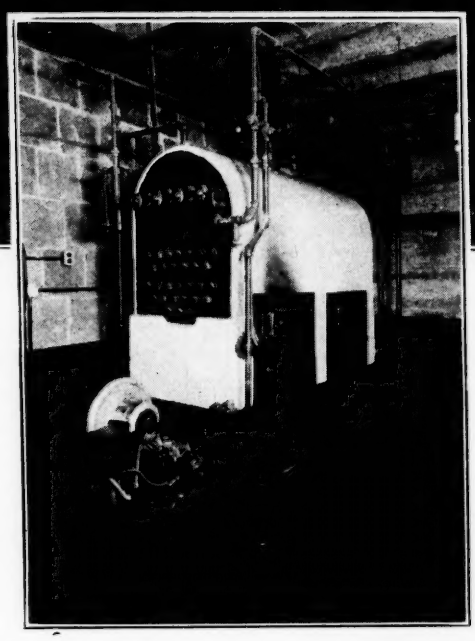
for Process Boilers
The McDonnell & Miller No. 29 Single Valve Feeder
The ideal feeder for all boilers where condensation is not returned or where boilers are operated continually under a vacuum.



for Smaller Boilers
The McDonnell & Miller No. 30 Safety Feeder
This newest addition to the McDonnell & Miller line answers the demand for a quality feeder at a price low enough to justify its installation on small boilers. As a result, it more than doubles the field for feeder installations. Unlike low water cut-offs, which simply stop the oil burner or gas burner, the No. 30 Safety Feeder restores the boiler water line to a safe level without shutting down the heating system. Every small oil or gas-fired job should have a McDonnell Safety Feeder.

McDONNELL & MILLER
Boiler Feeders
"Doing one thing well"





TRIPLE SERVICE Boilers Keep Pace with Aviation's Progress

Now that the public recognizes the benefits and opportunities of air travel, commercial aviation is turning to the construction of permanent buildings on the flying fields to house its passenger public and operating personnel. Naturally, the problem of heating these buildings economically is being solved with Triple Service boilers.

An important installation was recently made at Brainard Flying Field, Hartford, Conn. Captain Clarence M. Knox, Commissioner of the Connecticut Department of Aeronautics, selected a Triple Service boiler because it incorporates three outstanding features—plenty of heat, hot water and incineration in one unit at minimum investment and operation cost.

Captain Knox's selection of the Triple Service was made only after he had carefully studied the relative merits of some of the leading boilers in the country. Thus, one of the leaders in aviation has paid Triple Service a compliment in recognizing its outstanding qualities.

Before you buy any boiler, whether for a large or small installation, whether for a public building or a private home, get the Triple Service facts from our nearest distributor listed below.

INTERNATIONAL BOILER WORKS CO., East Stroudsburg, Pa.

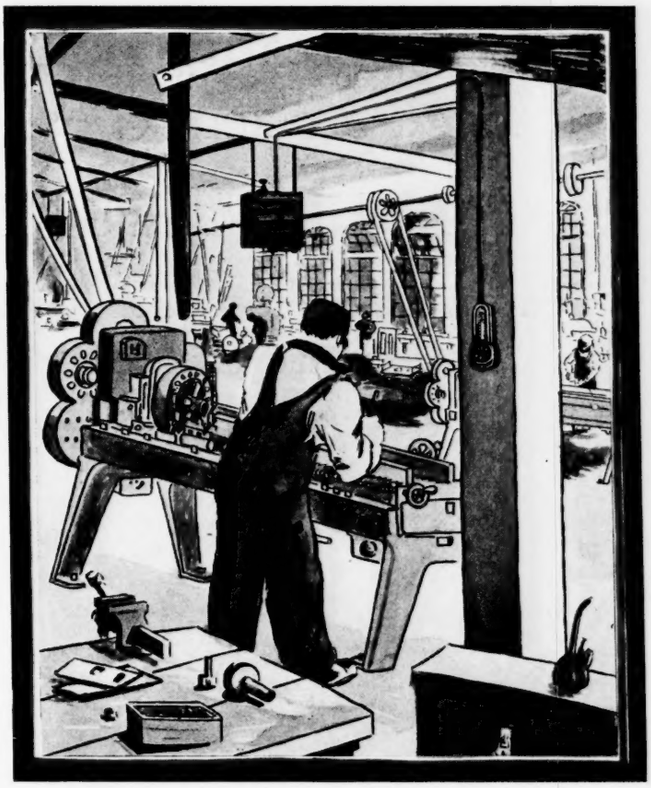
Distributors

THERMO SERVICE, Inc.
New York City, N. Y.
OIL BURNER CORP.
Trenton, N. J.
CHAS. T. KING & CO.
Baltimore, Md.

WARNER PLUMBING & HEATER CO.
Atlanta, Ga.
WILLIAM G. ROBELEN
Wilmington, Del.
HEATING EQUIPMENT CORP.
Boston, Mass.
INCINERATOR & ENGINEERING CO., Montreal, Canada

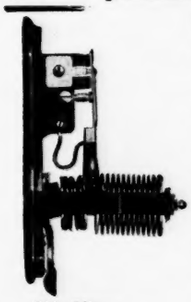
JAMES A. CONDON, Inc.
Philadelphia, Penna.
Mr. B. FRANK TOUCHSTONE
Lexington, N. C.
AUTOMATIC HEAT CORP.
Jacksonville, Fla.

The Penn Thermostat ...for... Unit Heaters Carries the Load *Direct*



IF there is any one feature about the Penn Thermostat for Unit Heaters that you will like best, it is the enormous capacity to carry heavy loads direct. It is specially designed for across the line service, and carries the load direct up to 1 H.P. single phase, A. C. and ½ H.P. direct current. When you install the Penn Thermostat, you reduce the wiring job to a minimum of time and expense, because magnetic contactors, relays, and transformers are not necessary.

Another outstanding feature of the Penn Thermostat is the patented Penn Magnet Contact. The control may be mounted in any position without plumb or level. Yet the setting will not be affected. Operating on a two-degree differential, the Penn Thermostat maintains uniform heat and assures economical operation. It is priced in keeping with other standard makes. In addition to Unit Heaters, it may be used for temperature control on oil burners, coal, gas, and electric heaters, heating motors, and damper controls.



Side View Type A Penn Thermostat Cover Removed

The regular thermostat may be used for pilot service up to 550 A. C. and for three phase motors which must be protected against single phasing. A special Room Thermostat is provided for current loads up to 30 Ampere A. C. for electric space heaters. Write for complete information.

Manufactured by an organization of proven engineering ability that supplies the largest and best concerns of the country with automatic control switches

PENN ELECTRIC SWITCH CO.
DES MOINES, IOWA

PENN

A COMPLETE LINE OF AUTOMATIC ELECTRIC SWITCHES FOR

Oil Burners, Pumps
Refrigerators
Air Compressors

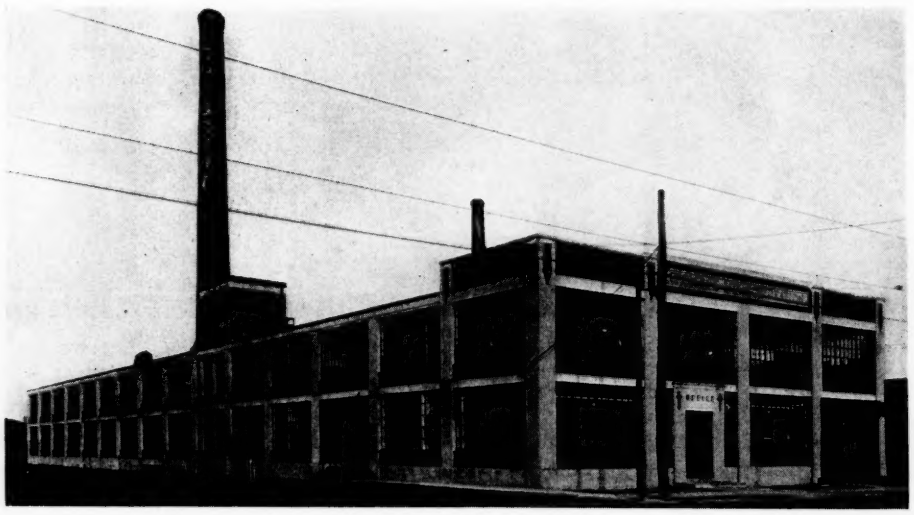
Thermostat Switches
Float Switches

Unloader Pilots
Vacuum Switches
Pressure Switches

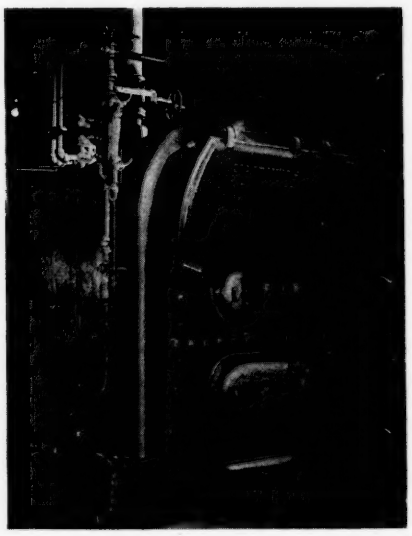
Industrial Plants Install Coatesville All Steel Fire Box Heating Boilers, due to their acknowledged efficiency, economy and durability

"THERE MUST BE A REASON"

Coatesville Welded and Riveted Steel Heating and Power Boilers are the result of nearly a half century of boiler making experience



CRESCENT BOX CORP. PLANT—PHILADELPHIA, PA.
Ballinger & Co., Architects & Engineers



BOILER ROOM
OTTO MILK COMPANY
Pittsburgh, Pa.

SYLVANIA PRODUCTS CO. PLANT—EMPORIUM, PA.
Rust Engineering Co., Architects & Engineers

MAIN OFFICE & WORKS
COATESVILLE, PA.

COATESVILLE BOILER WORKS
Boilers - Tanks - Steel Plate Work

SALES OFFICES IN LEADING CITIES

FITZGIBBONS

All the fine features of its big brothers in the small FITZGIBBONS STEEL HEATING BOILER

Steel-strength and durability, high efficiency, unusually quick pick-up of the heating load, space saving, easy operation, easy installation, low maintenance,—all time-tried-and-proven qualities of the large FITZGIBBONS STEEL HEATING BOILERS are equally inherent in the small and medium sizes.

It could not be otherwise, for these small boilers are replicas of their larger brothers in highest grade construction and special features of design that positively accomplish the liberation of every last unit of heat energy from the fuel and the astonishingly quick and efficient transfer of that heat energy into steam.

And like the big boilers, they are built for coal, oil or gas firing, each type invariably paying the same high dividends in fuel savings and in freedom from ordinary boiler troubles.

With the Small Fitzgibbons Steel Boilers every small and medium sized heating job is placed on the same sound basis of modern steel heating efficiency that characterizes every big Fitzgibbons heating installation,—and at no higher cost than an old fashioned cast iron or an inferior steel job.

The Fitzgibbons Steel Heating Boiler Catalog gives the complete details. Shall we mail you a copy?

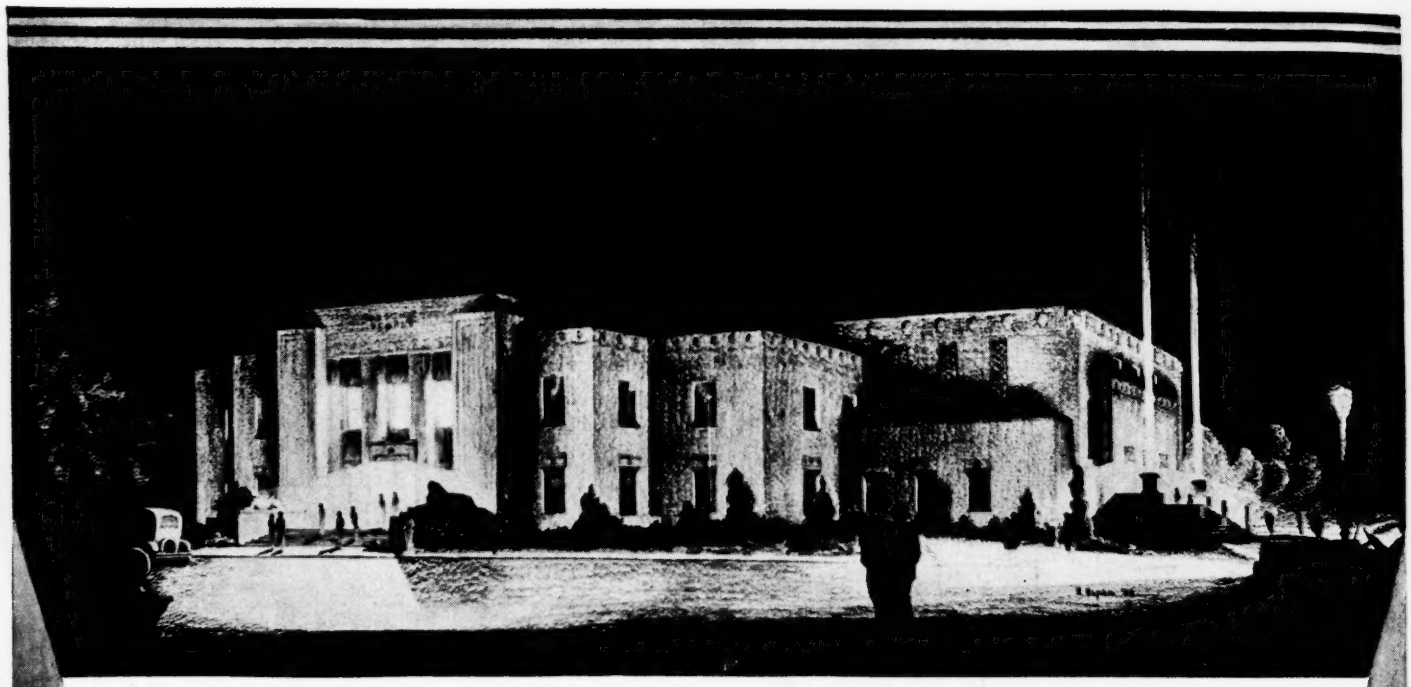
FITZGIBBONS BOILER CO., Inc.

574 Seventh Avenue **New York, N. Y.**

***Works:* OSWEGO, N. Y.**

BRANCHES AND REPRESENTATIVES IN PRINCIPAL CITIES

The sign of the best in steel boiler heat.

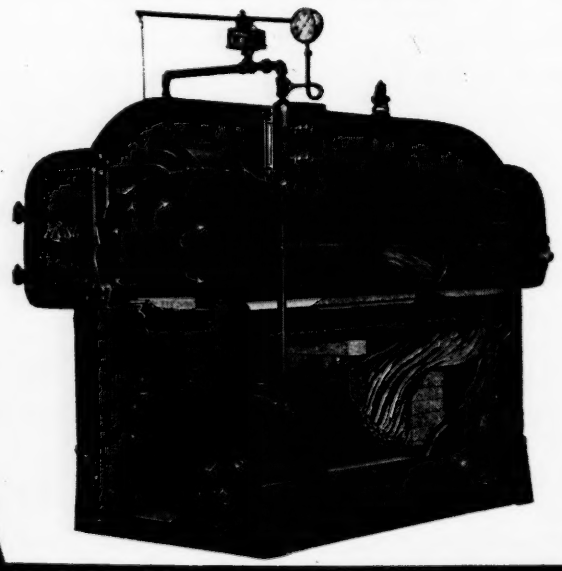


Masonic Temple, Fort Smith, Arkansas, two 10,000 foot Ross Boilers installed. George R. Mann, Wagner and King, Architects; Haralson and Nelson, Associate Architects . . . . . Eldorado Plumbing and Heating Co., Heating Contractors.

ROSS
STEEL HEATING BOILERS

Details and specifications on request.

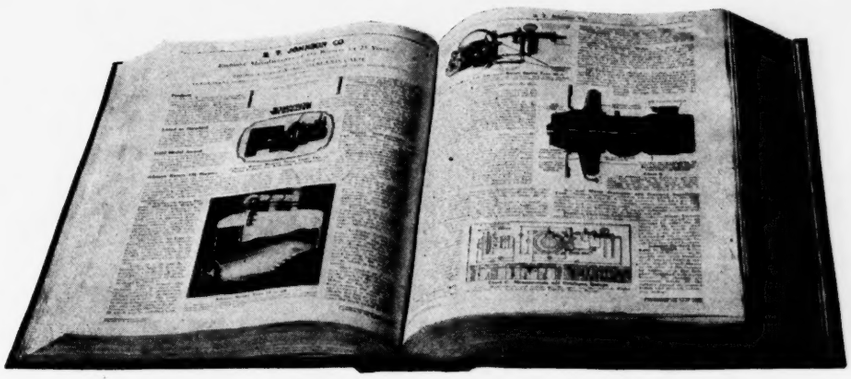
THE FROST MANUFACTURING COMPANY
GALESBURG, ILLINOIS



ECONOMICAL · EFFICIENT · DURABLE

Johnson Oil Burners

"For Every Heating and Power Purpose"



Complete information in Sweet's Architectural and Engineering Catalogues

YOU will find complete information about Johnson oil burning equipment on pages 502 to 504 of Sweet's Engineering Catalogue; also, on pages D-4655 to D-4658 in Volume "D" of the 1930 edition of the Architectural Catalogue. This makes it extremely easy and convenient for you to recommend and use the correct Johnson Oil Burner* to meet the heating and power requirements of every building in your territory, from the smallest residence to the largest hotel and public building, from the corner laundry to the seven-acre factory. There is no building too small nor no building too large for a Johnson installation.

The dependability, efficiency and economy of Johnson Oil Burners is best proved by the scores of thousands of satisfied users *plus* the fact that Johnson Oil Burners were awarded the Gold Medal at the Philadelphia Sesqui-Centennial Exposition of 1926, for precision methods of manufacture and perfection of design. You can safely recommend and use the Johnson Oil Burner with absolute confidence that it will give enduring satisfaction. For behind every Johnson Burner lies the experience of over 25 years in the installation and exclusive manufacture of oil burning equipment for every heating and power purpose.

The accumulated data of our 25 years' experience is available to you. Our Engineering Service Department will welcome the pleasure of assisting you in the solution of your heating or power problems.

We will also be pleased to send a copy of our catalogue, as published in "Sweets," for your files. Just write "*Bulletin* 4-B, *please*," on your letter head or business card (no obligation), and your copy will be sent without delay.

JOHNSON OIL BURNERS©

Listed as standard by the Underwriters' Laboratories

MANUFACTURED AND GUARANTEED BY

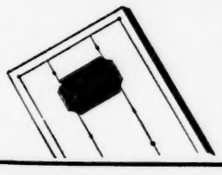
S. T. JOHNSON CO.

Executive Office and Factory: **940-950 Arlington Street, Oakland, California**
Factory Branches: **San Francisco, Sacramento, Stockton, Calif.; Philadelphia, Pa.**

Member Oil Heating Institute

230-H

An Opportunity *for Men of Vision and Ability...*



Profits in the oil burner business are limited by the market for the burner you represent. There is a Johnson Burner for every heating and power purpose . . . *Rotary Burners in three styles, seven sizes, with either semi or full automatic control. While Natural Draft, Whirlwind, Low Pressure Air and Steam Atomizing Oil Burners, electric and steam driven oil pumping and preheating equipment fill in the gaps . . . blanket the market. The Johnson dealer also enjoys the advantages of selling a burner that will not be "orphaned" . . . he will be given the fullest factory co-operation in developing his territory. Send for our new free book, *"Today's Opportunity."* It tells why the Johnson franchise offers greater dealer profits. This coupon will bring your copy without delay. Mail it now, stating territory desired.

Name *Address*

The Sign B&J of Quality

QUALITY HEATING SYSTEMS

Cost Little More to Install

Cost Much Less to Operate

and Pay in Satisfactory, Permanent Performance!

Barnes & Jones

Modulation Vapor and Vacuum Heating
Systems of Proven Quality

128 Brookside Avenue,
Jamaica Plain, Boston

101 Park Avenue
New York City

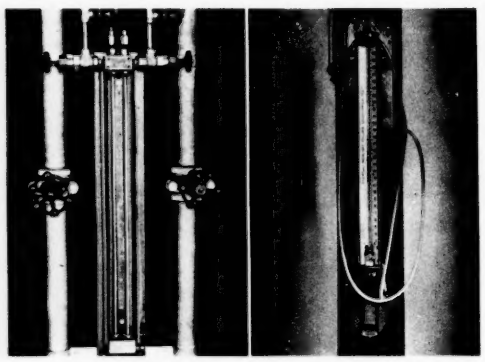
Stop *Groping*

with square foot ratings

TESTED Air *and* Water Capacities

reveal the size of heating system a pump will serve

TWO factors determine the amount of radiation which a vacuum heating pump can serve satisfactorily and economically. The first is the maximum air and water capacity of the pump under working conditions. The second is the horsepower required to deliver this capacity.



TYPES OF VENTURI METER AND VACUUM MANOMETER USED IN TESTING JENNINGS PUMPS

So, before rating such a pump in square feet of equivalent direct radiation, the quantities of air and water which it can handle and the horsepower it consumes should be definitely established.

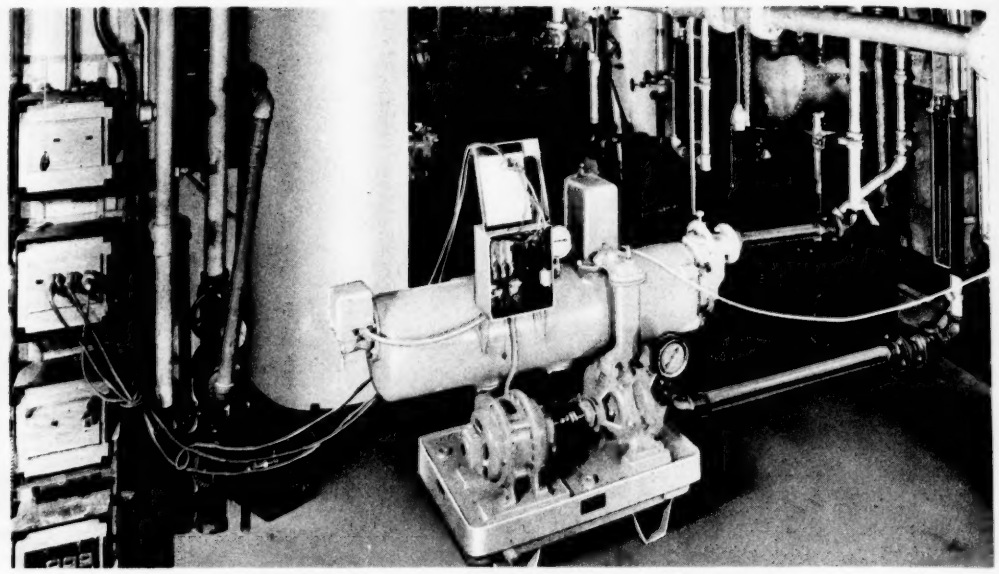
Tests Determine Jennings Capacities

The combined air and water capacity of every Jennings Pump is carefully checked before the pump leaves the factory. The volume of water that the pump withdraws from the receiving tank under a prescribed vacuum and delivers under a specified head is accurately measured. At the same time the number of cu. ft. per min. of air that the pump removes from the receiving tank and discharges to the atmosphere is determined by means of a calibrated orifice. The pump is tested with its own driving motor. The horsepower required to deliver these maximum capacities is measured.

STANDARD TEST ORIFICE

Ratings Are Reliable Under Varying Conditions

Jennings ratings are reliable. The correct pump capacity for a given installation is influenced by the degree of tightness of joints and fittings, the efficiency of the traps, the cooling effect of the return piping and a score of other factors that vary and cause a large difference in the volume of condensation and air to be removed. Jennings ratings are backed by ample capacity to meet these varying conditions.



JENNINGS VACUUM HEATING PUMP ON TEST STAND

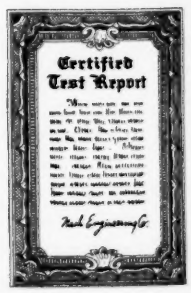
CAPACITIES OF JENNINGS VACUUM HEATING PUMPS

Pump Size	Equivalent Direct Radiation Square Feet	Water Capacity G.P.M.	Air Capacity Cu. Ft. Per Min.	Orifice Diameter Inches	MOTOR HORSEPOWER			
					10 Lbs.	20 Lbs.	30 Lbs.	40 Lbs.
T	2,500	4	3	7/64	1/3	1/2	1	1 1/2
U	5,000	9	3	7/64	1/3	1/2	1	1 1/2
V	10,000	14	6	9/32	1	1	1 1/2	2
B	16,000	22	9	3/16	1 1/2	2	3	5
C	26,000	35	15	1/4	2	3	5	5
D	40,000	60	19	9/32	3	5	5	7 1/2
E	65,000	90	34	3/8	5	5	7 1/2	10
F	100,000	140	50	7/16	7 1/2	10	15	15
*G	150,000	200	102	9/16 & 5/16	10	15	UPON REQUEST	
*H	300,000	400	171	2-7/16&1-9/16	UPON REQUEST			

* *The last two sizes are not of the manifold type.*

Exclusive Features Assure Dependability and Economy of Operation

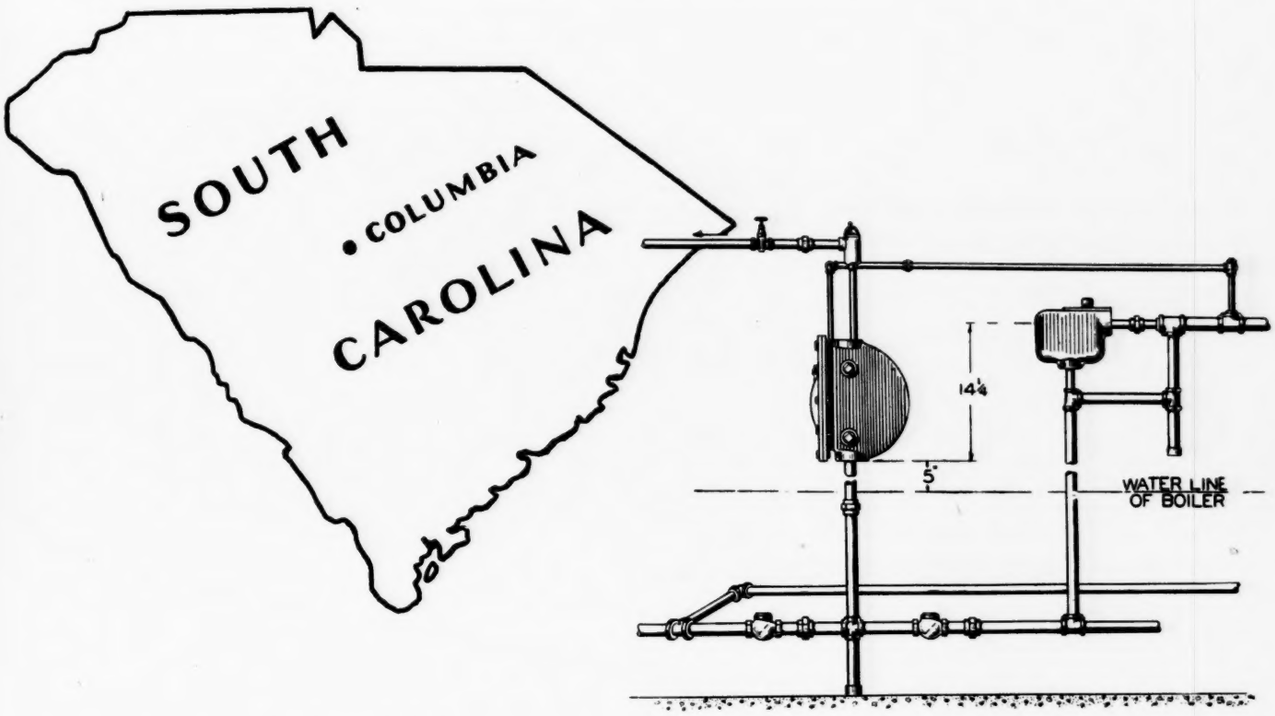
Jennings Vacuum Heating Pumps handle air and water separately. Air capacity is not affected when water also is being pumped. Water capacity remains constant when air is being handled. A Jennings Pump, with the capacities given in the table, will serve satisfactorily any reasonably well installed system of the size for which it is recommended, for the life of the building. Large capacity at low horsepower is afforded and economical operation assured because the condensate is handled only once. These features are found only in the Jennings Pump.



Certified test reports guaranteeing air and water capacities and horsepower provide a tangible basis for comparing heating pumps. Demanding these reports and substantiating them by a second test on the job promote good heating. Herewith is shown the Certified Report of Factory Test furnished to purchaser on request.

Jennings Pumps

NASH ENGINEERING CO.
SOUTH NORWALK, CONN., U.S.A.



"..it means a big advertisement to us to install the Webster Type "R" System"

"WE prefer to sell and install Type "R" Systems—because of the ease of installation and operation; and because of the uniformly satisfactory service which these Systems give, and since a satisfied customer is the best advertisement, it means a big advertisement to us to install the Webster Type "R" System."

A leading *heating contractor of Columbia, South Carolina, is speaking from experience. During the past three years he has installed a sufficient number of Type "R" Systems in leading residences, schools, church and business buildings to convince him that the Type "R" System is his answer to the problem of *preferred* business.

Though highly engineered, the Webster Type "R" System is simple and easy to install. And its simplicity of operation and complete flexibility has made thousands of owner friends.

Installing Type "R" Systems is *preferred* business—the kind that is governed by quality rather than price. The Webster Steam Heating Specialist in your vicinity can help you to develop this type of business. Get in touch with him.

*Name on request

-since 1888 Webster Systems of Steam Heating

This is the first advertisement of a series prompted by letters from successful heating contractors answering the question "Why do you prefer to sell and install Webster Type "R" Systems?"

WARREN WEBSTER & COMPANY
Pioneers of the Vacuum System of Steam Heating
CAMDEN, NEW JERSEY
52 U. S. Branches—Darling Bros., Ltd., Montreal, Canada

a R 21

WARREN WEBSTER & COMPANY, Camden, New Jersey.

Please mail Bulletin B-600, describing the Webster Type "R" System of Steam Heating to

Name..... Street..... City.....

HV-2-30

EVERY MONTH MILLIONS OF MAGAZINE READERS LEARN ABOUT IDEAL GAS BOILERS

NOW is the time to sell

IDEAL GAS BOILERS

Now is the time to sell automatic heating when the disadvantages of old-fashioned heating are fresh in the minds of home owners. You can make the installation later on, but now is the time to get the order. A recent survey shows that right now more than twice as many home owners are contemplating the purchase of gas boilers as bought last year. Sales come easy with Ideal Gas Boilers because everyone accepts an American Radiator Company product as the standard of quality.

manufactured by

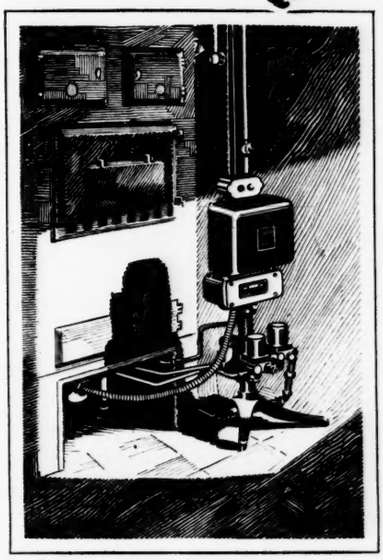
AMERICAN RADIATOR COMPANY

sold by

AMERICAN GAS PRODUCTS CORPORATION
Chrysler Building, New York

EVERY MONTH MILLIONS OF MAGAZINE READERS LEARN ABOUT IDEAL GAS BOILERS

World LEADERSHIP



FIRST place among manufacturers of domestic oil burners is now held by the Silent Automatic Corporation. The recently published tabulation of 1929 results, which includes the 47 manufacturers whose output was of sufficient size to be considered, was made by "Fuel Oil", recognized authority on oil burning.

Five years ago, Silent Automatic was an unknown newcomer in an industry where several companies were well established. To climb in so short a time to acknowledged leadership is an achievement which, we believe, clearly indicates the worth of the Silent Automatic Oil Burner and the soundness of the company's manufacturing, merchandising and service policies.

The reliability and economy of Silent Automatic have been demonstrated beyond doubt in heating plants of all kinds. The recommendation of enthusiastically satisfied Silent Automatic owners influenced a very large percentage of last year's sales.

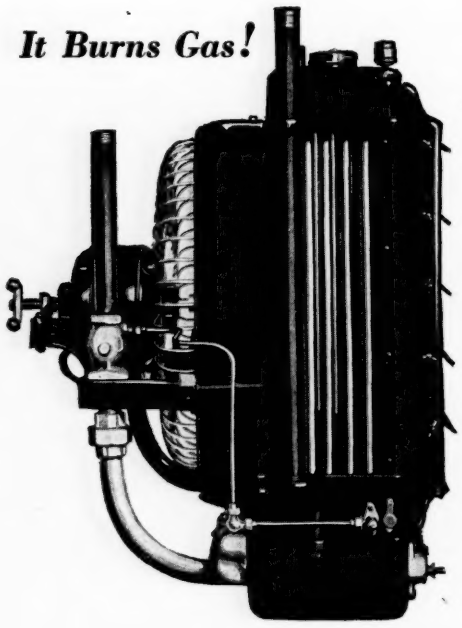
The price of Silent Automatic is low enough to attract oil burner prospects, yet includes a profit margin adequate for building a substantial and successful dealership.

A knowledge of the Silent Automatic—the industry's most successful oil burner—will be useful to you when your opinion on oil burners is asked. We will be glad to send you the facts about Silent Automatic and to cooperate with you in every way in handling the needs of your customers.

SILENT AUTOMATIC CORPORATION
12001 East Jefferson Ave. Detroit, Michigan
(211)

SILENT AUTOMATIC
THE NOISELESS OIL BURNER

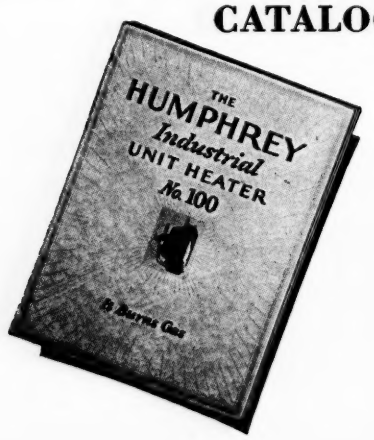
It Burns Gas!



Here's Real Industrial Heating Efficiency!

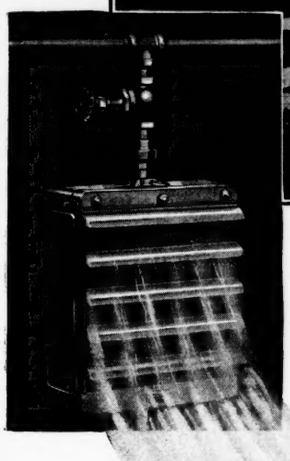
No more licensed firemen—no more coal and its accompanying smoke, dirt and ashes. No more of the waste of overheated conditions! No more of the discomfort of underheating! This is the era of clean, economical heat—of flexible, controlled heat—heat that is always instantly available—that may be directed to where it is needed most and turned on or off at a moment's notice. This is the era of the efficient, gas-burning Humphrey Industrial Unit Heater! In large plants, small factories, shops, garages, display rooms, etc., the Humphrey Industrial Unit Heater serves without special care or attention and at the minimum of heating costs. Quickly, easily and economically installed in an out of the way position on the ceiling and connected with the gas line, Humphrey Industrial Unit Heaters require no expensive plumbing—take up no valuable floor space. A catalog furnishing details of these modern heating devices will be furnished on request.

SEND FOR THIS CATALOGUE!



GENERAL GAS LIGHT COMPANY
KALAMAZOO MICHIGAN
NEW YORK
44 WEST BROADWAY
SAN FRANCISCO
135 BLUXOME STREET

The **Humphrey**
Industrial Unit Heater



A lower heat ceiling means
ECONOMY

MODINE UNIT HEATERS save money every operating day. With Modine "Directed Heat" the warmed air current follows a downward course from Unit to floor. There it spreads out, heating a wide area. As it rises it is re-circulated downward. All the air heated by the Unit is utilized in heating the working zones and the heat ceiling of the room is materially lowered.

In the Modine installation above—in the Mullins Body Corporation, Salem, Ohio—the Units played an important part in construction. The regular steam line was run before the floor was put in. Modines were suspended a few feet from the floor and were used to speed the drying of the concrete floor. In addition to quicker drying and quicker occupancy of the building this use of Modines eliminated all danger of fire that is incident to other methods of drying.

Whatever your heating requirements may be, Modine Unit Heaters can be adapted to meet them. They also are widely used for industrial drying. Let us send you our latest Catalog 130.

DIRECTED HEAT
UNDIRECTED HEAT MEANS WASTEFUL HEATING

MODINE MANUFACTURING COMPANY

Unit Heaters—Domestic Copper Radiation—Automotive Radiators

1707 RACINE ST. *(Heating Division)* RACINE, WIS.

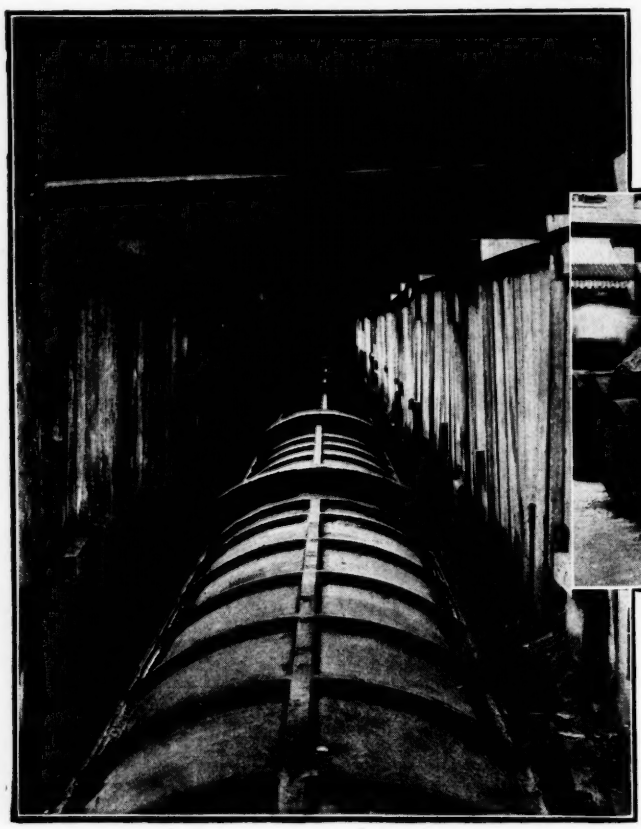
Branch Offices in all large cities.

London Office: S. G. Leach & Co., Ltd., 26-30 Artillery Lane

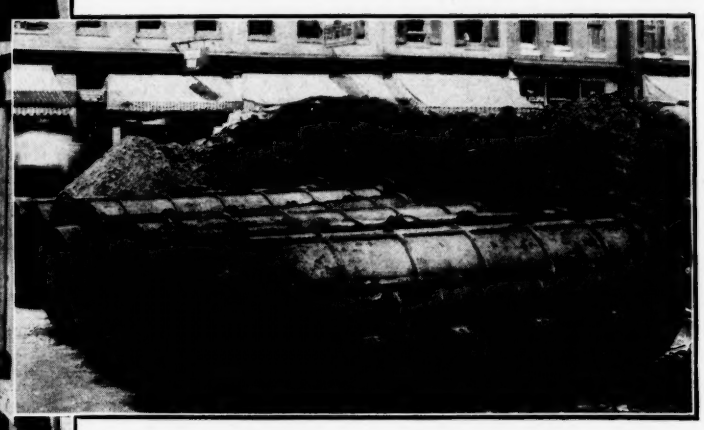
Modine
Unit HEATER

A MODINE *product*

ADSCO Cast Iron Conduit and other Adsco Specialties



Meet Exacting Requirements in District Heating Steam Lines of Consolidated Gas and Electric Co., Baltimore, Md.



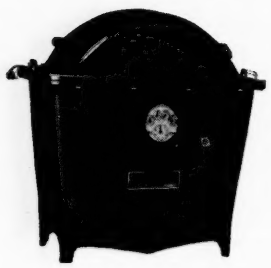
Adsco Cast Iron Conduit for 16"—250 lb. steam lines in Baltimore

LARGE public utilities, such as the Consolidated Gas Electric Light & Power Company, of Baltimore, Maryland, cannot afford to take chances on the epuipment used in their underground District Heating Lines. Once their lines are installed in the ground, they must "stay put" with little or no maintenance.

Hundreds of customers look to these utilities for continuous, satisfactory steam service. Interruptions in the service . . . or an inadequate supply of steam . . . will not be tolerated. Profits to the utility depend upon the economical distribution of steam, with minimum loss in transit.

These are some of the factors that have influenced the selection of Adsco equipment by over 90% of all the large District Heating utilities . . . and are the very reasons why you should install Adsco Specialties in every important steam line . . . industrial, institutional or municipal.

If you would like to make your own steam line installations as efficient and trouble-proof as those of the large District Heating Companies, write for Bulletins on Adsco Products and familiarize yourself with the kind of equipment used.



ADSCO ROTARY CONDENSATION METER

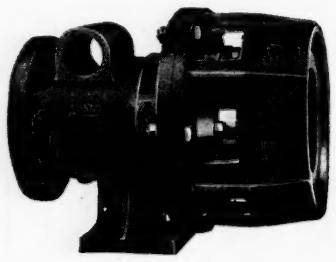
Rotary type meter for measuring condensation. Records directly in thousands of pounds.

ADSCO SIMPLEX CONDENSATION METER

Measures steam condensation and records flow in thousands of pounds by direct reading register

ADSCO EXTERNALLY GUIDED EXPANSION JOINT

One of the complete line of expansion joints, for high and low pressures including the Adsco Duplex Sleeve Guided Expansion Joint for pressures up to 400 lbs. and temperatures up to 750o. Also Adsco Variators, (Packless Expansion Joints) for high and low pressures.



AMERICAN DISTRICT STEAM COMPANY

GENERAL OFFICES AND WORKS

NORTH TONAWANDA, N.Y.

OVER FIFTY YEARS IN BUSINESS

ADSCO

STEAM LINE EQUIPMENT

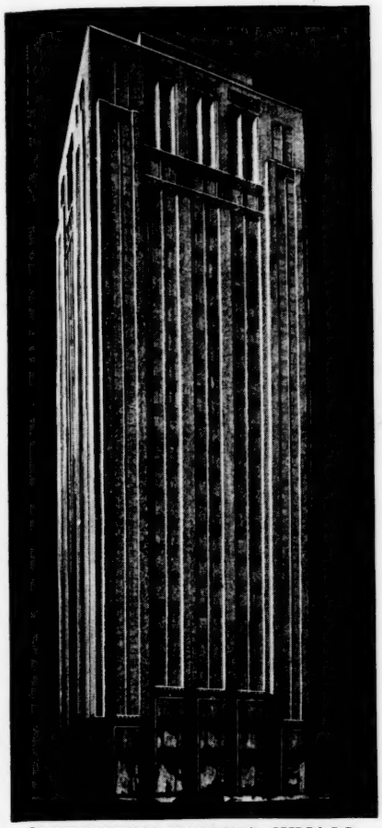
EXPANSION JOINTS...CASING...CONDUIT CONDENSATION AND STEAMFLOW METERS AND OTHER SPECIALTIES FOR THE ECONOMICAL DISTRIBUTION OF STEAM

In these and other prominent buildings

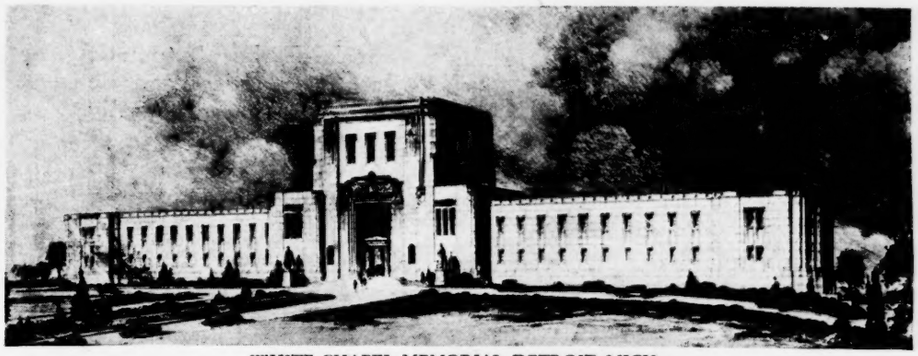
ARCO METAL

CAST IRON PIPE

guarantees the permanency of the installation



BUCKINGHAM BUILDING, CHICAGO
Architects—Holabird & Root
Builders—Lundoff-Bicknell Co.
Plumbing Contractors—M. J. Corby Co.

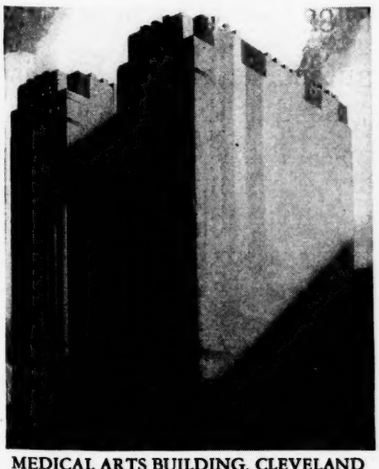


WHITE CHAPEL MEMORIAL, DETROIT, MICH.
Architects—Alvin Harley Consulting Engineer—P. E. Brender. Heating & Plumbing Contractors—Glanz & Killian

JOHN G. SHEDD AQUARIUM OF THE FIELD MUSEUM CHICAGO
Architects—Graham, Anderson, Probst & White
Heating Contractors—Mehring & Hanson Co.

BECAUSE the iron is alloyed with nickel and chromium, its texture is uniform throughout the wall of the pipe, and insures its superior corrosion-resisting qualities either at the bottom of its thread or at any point on its surface. The pipe is of the same dimensions as extra heavy wrought pipe. It can be cut and threaded with standard hand or power tools. It can be welded to any length at the factory or on the job.

Arco Metal Pipe is carried in stock and distributed by jobbers of plumbing, heating and mill supplies.



MEDICAL ARTS BUILDING, CLEVELAND
Architects—Graham, Anderson, Probst & White
Heating & Plumbing Contractors—
A. R. Brueggeman Co.

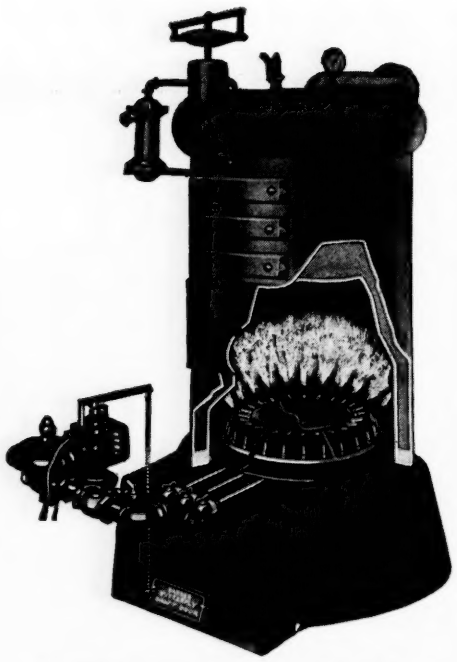
FORD MUSEUM, DETROIT, MICH.
Architects—Robert O. Derrick, Inc. Heating & Plumbing Contractors—Drake Avery Co.

AMERICAN RADIATOR COMPANY

ARCO METAL PIPE DIVISION

40 WEST 40th STREET, NEW YORK
816 S. MICHIGAN AVENUE, CHICAGO

DETROIT 1344 Broadway
CLEVELAND 1294 E. 55th St.
CINCINNATI 8th and Broadway
ST. LOUIS 4201 Duncan Ave.



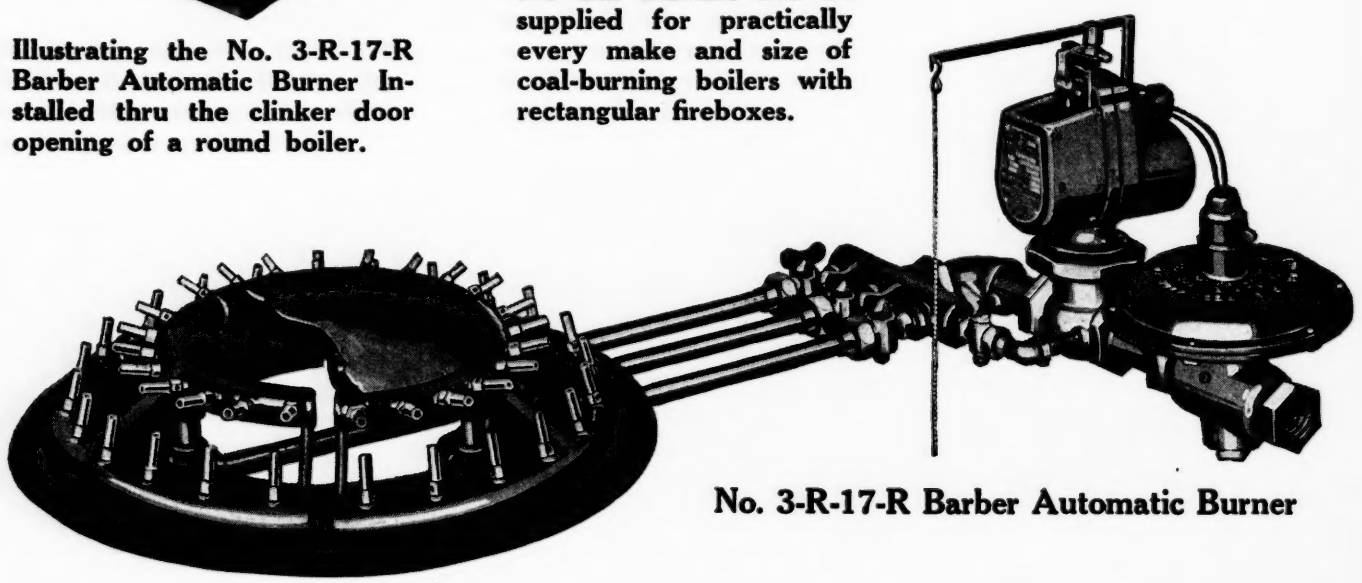
Illustrating the No. 3-R-17-R Barber Automatic Burner Installed thru the clinker door opening of a round boiler.

COAL or GAS?

Answer the question for home owners by showing them the advantages of

BARBER *Automatic* JET GAS BURNERS

Special Barber Automatic Jet Gas Burners can be supplied for practically every make and size of coal-burning boilers with rectangular fireboxes.



No. 3-R-17-R Barber Automatic Burner

Your prospect may not be as sure as you are that gas is the ideal house heating fuel. For his traditional fuel may be coal—with all of its disadvantages. And he knows what he can expect.

Show your prospect how a BARBER Conversion makes it easy to change to gas and back again to coal if gas fails to meet his expectations. Of course, he never will return to coal. For Barber *Automatic* Jet Gas Burners convert any good coal-burning boiler or furnace into an efficient gas heater.

Many thousands of successful conversions are in use with Barber *Automatic* Jet Gas Burners throughout the country. Impartial and authoritative tests show efficiencies ranging from 75 to 82 per cent.

The demand for automatic gas heating is rapidly increasing. Send us the trade name, number and name of the manufacturer of the furnace or boiler of a few of your customers. We will specify and quote you on proper burner equipment and help you obtain this profitable business.

The CLEVELAND GAS BURNER & APPLIANCE CO.
Burner Specialists
3702-04 Superior Avenue, Cleveland, Ohio

FOREMAN-STATE NATIONAL BANK, CHICAGO

GRAHAM, ANDERSON PROBST & WHITE
ARCHITECTS AND ENGINEERS

B. & F. HEATING & VENTILATING CO.
VENTILATING CONTRACTORS

Building *for* Posterity

BETTER buildings—bigger buildings built to endure! That might be the keynote of America's building program today, and the finer the structure, the finer the accessories installed.

The impressive new Foreman State National Bank Building is ventilated with Buffalo fans—thus insuring satisfactory ventilation—today and 50 years from today.

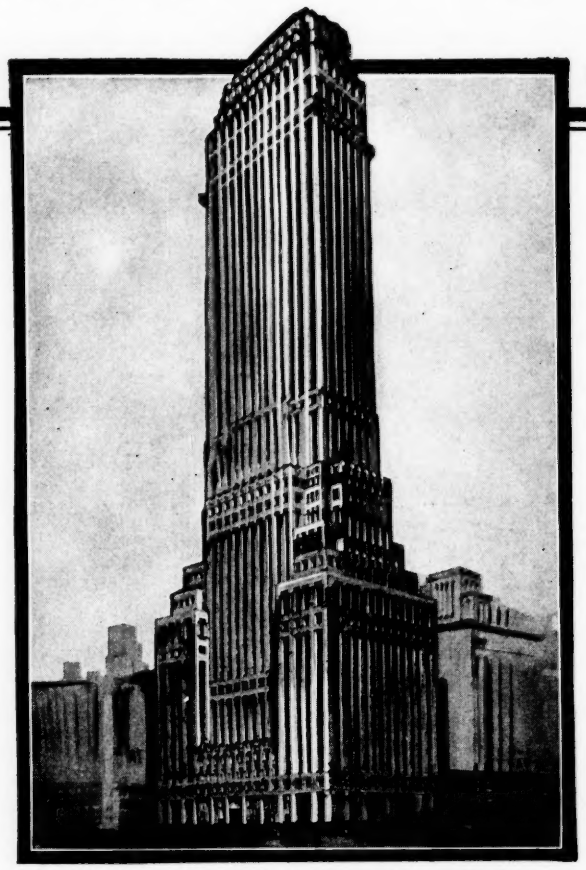
Better buildings—better fans—Buffalo Fans!

Buffalo Forge Company

480 Broadway **Buffalo, N. Y.**

In Canada: Canadian Blower & Forge Co., Ltd.
Kitchener, Ont.

"Buffalo" Heating and Ventilating Apparatus



Chanin Building, New York. *Architects:* Sloan and Robertson. *Consulting Engineers:* Clark, McMullen and Riley.

Why . . .
Unit Ventilators are in the Chanin Building

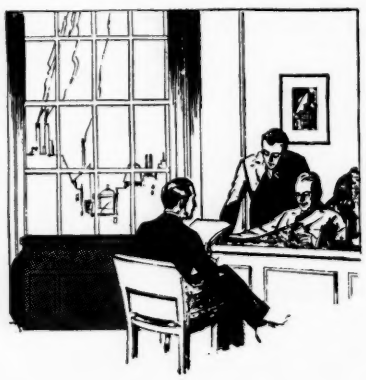
"Fifty-six stories of sunlight" is the slogan of the Chanin Building. It has windows, and air on all sides... but Unit Heater-Ventilators are in executive offices and board-rooms as high up as the forty-fifth floor! They are also used for special service in the lobby and sub-basements.

The reason Sturtevant Unit Heater-Ventilators are in these sun-lit offices is because they provide *controlled* ventilation . . . *draft-free,* outdoor air, filtered clean...*precise* temperatures...*assured air-comfort* at any season—in any weather!

Unit Heater-Ventilators are used in the lobby as recirculating heaters and provide approximately ten times the amount of heat that direct radiators could furnish.

Sturtevant Unit Heater-Ventilators require no duct work . . . They are compact, handsome in appearance and SILENT!

Sturtevant Unit Heater-Ventilators provide the architect, engineer and contractor with a flexible, individually controlled system of heating and ventilation admirably adaptable to the executive type of offices. They also provide a logical means of heating and ventilating Schools, Clubs, Churches, Public Buildings, Show-Rooms, Shops and Residences. Pictures of many of these installations are shown in a new Data-Catalog just issued. It will be helpful and suggestive to you—and it will be a pleasure to mail you a copy of this 40 page book on request—no obligation.



B. F. STURTEVANT CO.

Plants and Offices: Berkeley, Cal., Camden, N. J., Framingham, Mass., Galt, Ontario, Hyde Park, Mass., Sturtevant Wis. *Canadian Representative:* Kipp Kelly, Ltd., Winnipeg, *also Branches in Principal Cities and Agents in Foreign Countries.*

Sturtevant

REG. U.S. PAT. OFF.

The Silent Unit Heater-Ventilator

MONCO

STEEL HEATING BOILERS

for

COAL OR OIL BURNING

▲

FIRE TUBE BOILERS
COIL WATER HEATERS
COIL HEATING BOILERS

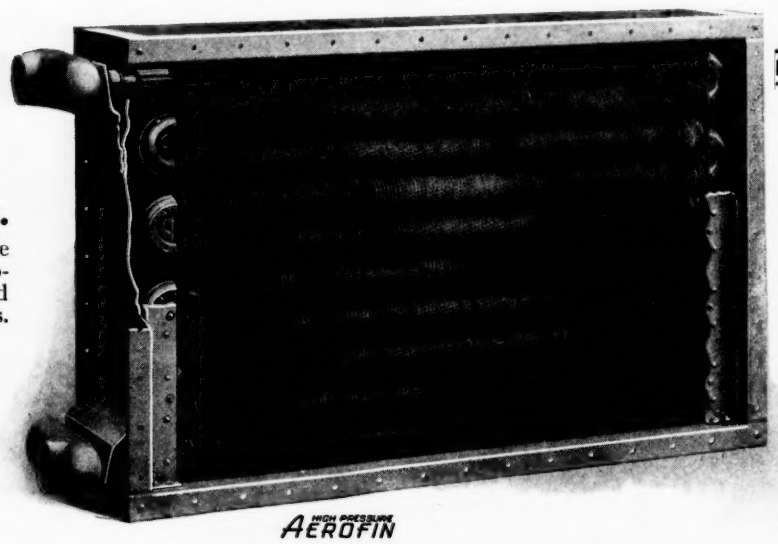
▼

WRITE FOR COMPLETE
INFORMATION

MONITOR

BOILER COMPANY

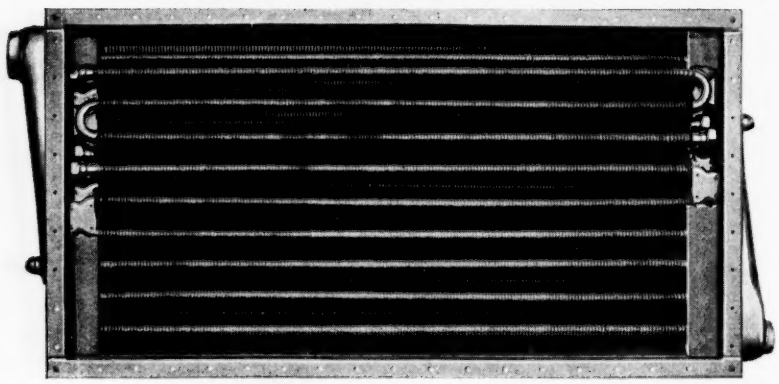
1505 RACE STREET PHILADELPHIA, PA.



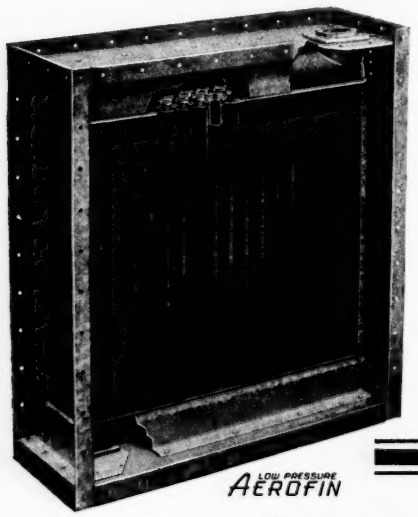
25 to 350 lbs.
Continuous seamless tube construction. One-, Two- or Three-Row Encased Units. 15 Standard Sizes.

Do You Know your AEROFIN*?*

(The Standardized Light-Weight Fan System Heat-Surface)



2½ to 150 lbs.
Continuous seamless tube, multi-coil construction. One-or Two-Row Encased Units. Six or Nine Tubes across face. Type R for Re-heaters. Type T for Tempering Units. 136 Standard Sizes.



Up to 50 lbs.
Proved flexible tube-plate construction, solderless steam joints. One-, Two- or Three-Row Encased Units. 45 Standard Sizes.

A SINGLE comprehensive Bulletin containing complete Engineering Data on all types of AEROFIN is now available gratis upon request. In addition to Final Temperatures and Condensations at various Pressures and Physical Data, there are large, readable Temperature Effect Charts on linen and many Piping Diagrams in four colors, an invaluable compilation from the knowledge and experience of some of America's most brilliant Engineers. Ask Newark for Bulletin V-20.

AEROFIN
is sold only by Manufacturers of nationally advertised Fan Heating Apparatus

AEROFIN CORPORATION

850 Frelinghuysen Avenue, NEWARK, N. J.
11 West 42nd Street, NEW YORK

Burnham Building
CHICAGO

Land Title Building
PHILADELPHIA

United Artists Building
DETROIT

Oliver Building
PITTSBURGH

Paul Brown Building
ST. LOUIS

An Efficient Machine *whose product is...*

The BAYLEY PLEXIFIN UNIT HEATER

AN experience record of many years has been brought into the development and perfection of this efficient heat machine, the Bayley Plexifin Unit Heater.

The heating element is the Bayley Chinookfin Heater, copper tubing with extended copper fin surfaces built on the approved and original Bayley Chinook "tube within a tube" principle. Its construction is unique; individual radiating tubes with individual feed through individual circulating pipes, no return bends, elbows or rigid connections, flow of steam, air steam and water always in one direction, no air lock, steam hammer, or short circuiting . . . a heating element which remains sound and tight under all steam pressures and constant thermal changes.

The fan is of the multiblade type, the well known Bayley Plexiform. It furnishes a maximum volume of air against medium or low pressures, is quiet in operation, and permits the use of high speed motors. The standard bearing used is the Dodge Timken Roller of the pillow block type. The motor and fan assembly of the Plexifin Unit is designed and built for continuous operation over long periods of time with minimum attention for lubrication and maintenance.

These are but a few of many outstanding merits of this efficient heat machine for industry, for use where heating conditions are severe. May we send you Bulletin No. 29-U giving complete information?

BAYLEY BLOWER COMPANY, *742 Greenbush St., Milwaukee, Wis.*

FEATURES

Copper radiating element
Bayley Chinookfin

■

Multiblade Fan
Bayley Plexiform

■

Roller Bearing
Dodge Timken

■

Uses high or low pressure steam

FANS, HEATERS
AIR-WASHERS
UNIT HEATERS

Bayley

PLEXIFIN UNIT HEATERS

Announcing

the purchase of the business of

DWYER EQUIPMENT CO., CHICAGO

makers of Twinfan Unit Heaters, and the formation of the Unit Heater Division of C. A. Dunham Co., under the direction of Lawrence P. Dwyer, general manager, and William J. Mauer, sales manager. Both will have headquarters in the general offices of the company in the Dunham Building.

C. A. DUNHAM CO.

DUNHAM BUILDING

450 E. Ohio Street **Chicago, Illinois**

Over 80 branch offices in the United States and Canada bring Dunham Service as close to you as your telephone. Consult your local directory. Dunham engineers are at your service with complete and authoritative data on improved heating to meet your individual requirements.

The unit heater is an accepted method of heating in industrial plants, garages and any type of building containing large open spaces. The Dwyer equipment includes several patented designs of unit heaters particularly suited for use in conjunction with the Dunham Differential heating system in industrial plants.

Do you know about Differential Heating?

This is the method of steam heating that provides the uniform, maximum-comfort service that is the ideal of building occupants, owners and managers alike; that is flexible enough to meet maximum and minimum weather variations and maintain room temperatures constant; and by avoiding overheating saves from 25% to 40% in fuel.

Proved by owners' own records Dunham Differential Heating is an improved method of steam heating under complete control; unlike any other heating system, yet backed by the 26 years of experience and reputation of this company; different, yet proved by more than 700 installations all across the United States, in Canada, and abroad.

Design — Based on Scientific Principles The temperature at which water boils varies with the pressure. Under atmospheric pressure (at sea level) the boiling point is 212°F and at 25 inches of vacuum it is 133°. Dunham Differential System makes practical an operating range from 25 inches of vacuum up to several pounds pressure in that way controlling building temperatures. "Cool" steam (133°) is generated and circulated under high vacuum. This meets heat requirements for mild weather.

No Overheating Steam at temperatures corresponding to pressures up to one pound should be ample for severe weather conditions, but is far too hot for the mild weather that makes up 95% of the average heating season. In such weather cool steam should be circulated. Only Dunham Differential Heating utilizes "cool" steam.

Comfort Comfort requirements are usually set at 70°F. Discomfort comes in both above and below the correct temperature. Waste starts a few degrees above the comfort line. Dunham Differential Heating maintains even temperatures, so uniform, so comfortable that occupants are seldom conscious of the heating system.

Works with any boiler — any radiation There are no complications to the installation of a Dunham Differential System. Boiler, radiators, piping, may be selected on the same basis of sound engineering practice as for other systems of heating. Existing installations of vacuum return line heating can often be readily adapted to Dunham Differential operation.

Economy Discomfort through overheating leads occupants to open the windows. Heat waste is then greatly increased. Direct comparisons in change-over installations from ordinary heating systems to Differential operation show that Dunham Differential Heating saves from 25% to 40% in fuel costs by the elimination of overheating. Similar fuel economy is obtained in new buildings.

Look for the name DUNHAM. This nameplate identifies a genuine Dunham Thermostatic Radiator Trap.

Costs First cost is not necessarily the determining factor in any equipment. When operating costs of Dunham Differential Heating are examined, the initial cost becomes insignificant when related to the returns on the investment in fuel savings of 25% to 40%, to say nothing of the health, comfort and efficiency values enjoyed.

Buildings heated by Dunham Differential vacuum systems have a heating service which **tenants like** and **owners know** saves money.

The Dunham Differential Vacuum Heating System and individual parts of the apparatus used in that system are fully protected by United States Patents Nos. 1,644,114, 1,706,401 and 1,727,965 and Canadian Patents Nos. 282,193, 282,194, and 282,195. Additional patents in the United States, Canada and foreign countries are now pending.

C. A. DUNHAM CO.

Dunham Building

450 East Ohio Street Chicago, Illinois

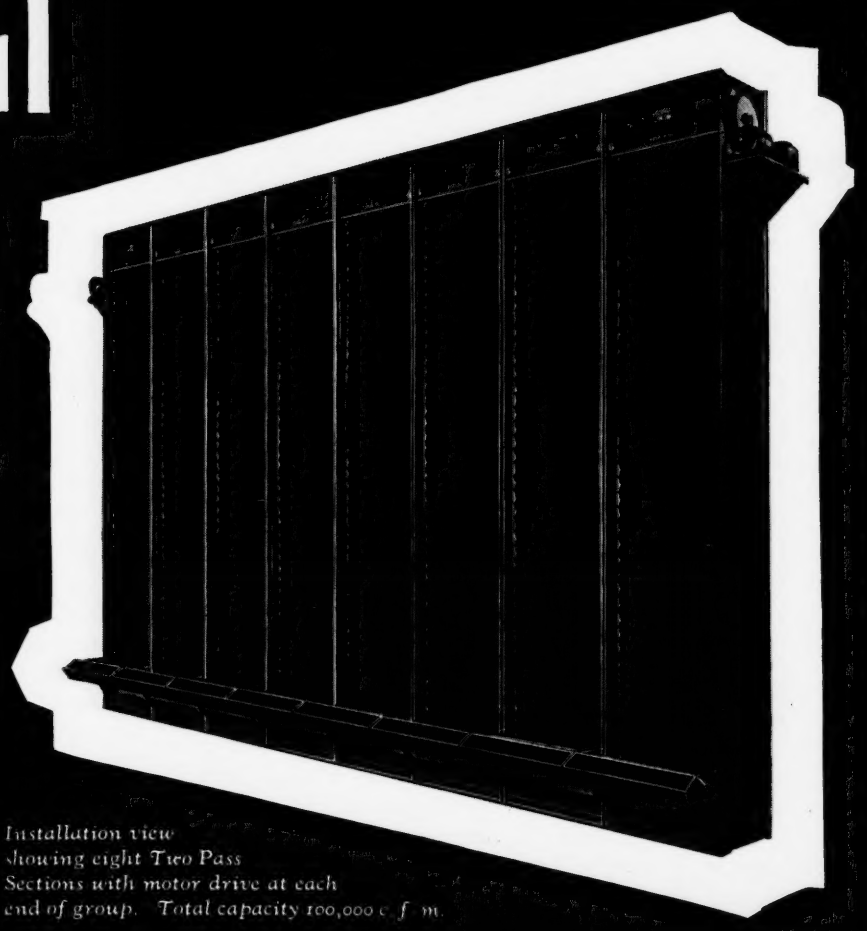
Over 80 branch offices in the United States and Canada bring Dunham Service as close to you as your telephone. Consult your local directory.

Dunham engineers are at your service with complete and authoritative data on improved heating to meet your individual requirements.

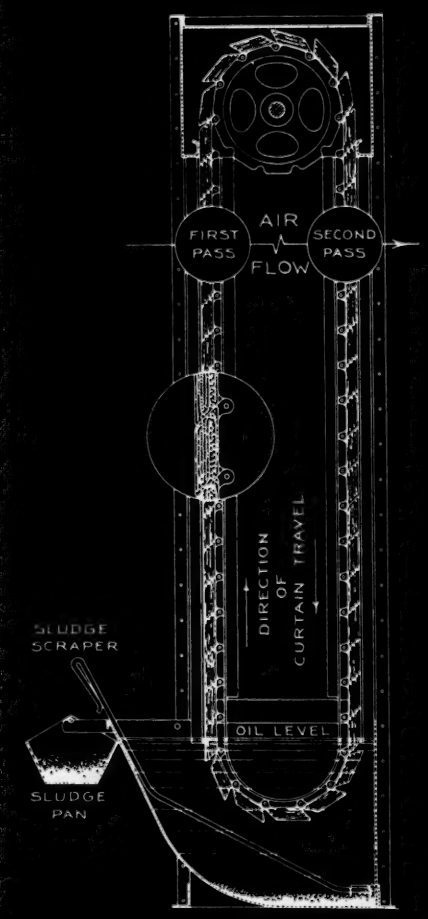
Many existing heating systems can be converted to Differential operation at moderate cost. These change-overs will pay for themselves. Dunham engineers will survey present systems without obligation.

National TWO PASS Air Filter

A True Impingement Type Viscous Film Filter



Installation view showing eight Two Pass Sections with motor drive at each end of group. Total capacity 100,000 c f m.



THE basic principles back of the TWO PASS Filter have a history of 12 years in actual service. The first filter of this type was built in Germany in 1917 and the original principles have been maintained without the need for change since that time. The experience thus gained has established the soundness of the three outstanding features of the TWO PASS Filter, viz.:

(1) *Double pass filtration of air;*

(2) *Depth of air travel through medium for complete impingement of dust particles, and,*

(3) *Stationary immersion in oil as a means of reconditioning the filter medium.*

NATIONAL AIR FILTER COMPANY INCORPORATED

205 CENTRAL AVENUE LOUISVILLE, KY.

THE HERMAN NELSON CORPORATION MAKES AN ANNOUNCEMENT TO THE ENGINEER

During more than twenty years of developing and pioneering work, this organization has met with the resistance always encountered in efforts toward progress.

Heating engineers and architects, however progressive in spirit, naturally hesitate to quickly accept innovations. They have seen too many "cure-alls" come and go! They feel their responsibility to their clients. They are wary of fads and demand—results.

Having experienced the difficulties of pioneering for so many years—and having weathered them—we have, deep in our hearts, a feeling of gratitude for those far-seeing engineers and architects who have shown their faith in this organization; who have worked with us and fought for us, thereby making possible a mutual progress.

Today, therefore, when we announce a *new* Herman Nelson product, it is only fitting that we publicly register our appreciation to the heating engineer for the expression he has so often voiced—"If it is made by the Herman Nelson Corporation, it is right."

NOW HERMAN NELSON *Invisible* RADIATO

BEHIND THAT GRILLE IN THE WALL . . . THERE'S A RADIATOR THAT SAYS, "THIS BUILDING IS MODERN."

THE HERMAN NELSON

AVAILABLE *for* MULTI-STORY BUILDINGS

SEVEN YEARS AGO, when the Herman Nelson Wedge Core Radiator was incorporated in Univent ventilating equipment, there began a revolution in the design of all such equipment.

Four years later, in answer to insistent demands for a direct radiator incorporating this light but indestructible heating element, the Herman Nelson Invisible Radiator made its appearance.

The Invisible Radiator, "Immured" type, was expressly designed and built for installation behind the plastered wall where it would occupy no room space and, therefore, make possible better decorative and furnishing effects.

So satisfactory were results that this new-type radiator was adopted for thousands of residences and other buildings only a few stories in height, where separate pipe risers could be used and where controlling valves, traps, etc. could be placed on branches leading to these risers. In such buildings the problem of accessibility was not a factor. The Herman Nelson Invisible Radiator became known—and is still recognized—as the last word in radiator heating.

A request is answered

Because of the success of the Herman Nelson Invisible Radiator, in fine residences and similar buildings, this company has been consistently urged to adapt this radiator for use in multi-story buildings.

To meet this demand, it was necessary to provide access to controlling valves, thermostatic traps and pipe connections. We were unwilling, however, to recommend that our heating element be merely placed in a hole in the wall, or that it be encased or covered in some haphazard manner. Specialized heating experience of over twenty years and a determination to keep faith with our clientele would permit no compromise. We, therefore, bent our efforts upon perfecting a complete unit of scientific design and scientific construction.

After three years of consistent painstaking effort, both in our scientific laboratory and in the field of practical application, we have produced such a unit—the Herman Nelson Invisible Radiator, "Paneled" type, incorporating the identical durable heating element as our "Immured" type, but meeting the special installation requirements of larger and taller buildings.

Guaranteed ratings

The Herman Nelson Invisible Radiator, "Paneled" type, is designed, built and sold as a complete unit. Each radiator is given a definite guaranteed rating as compared with the ordinary cast-iron radiator. The heating element is enclosed in a sturdy steel case with an instantly removable front panel. A unique dust-proof telescoping arrangement is employed, eliminating the use of bolts or screws to keep it in place. The removable panel is complete with cast outlet grille and graduating damper. There is a self-closing door on each side of the grille. The doors give hand access to the radiator control valves.

An adjustable base and adjustable grounds for meeting varying thicknesses of floors, plaster or tile walls are provided.

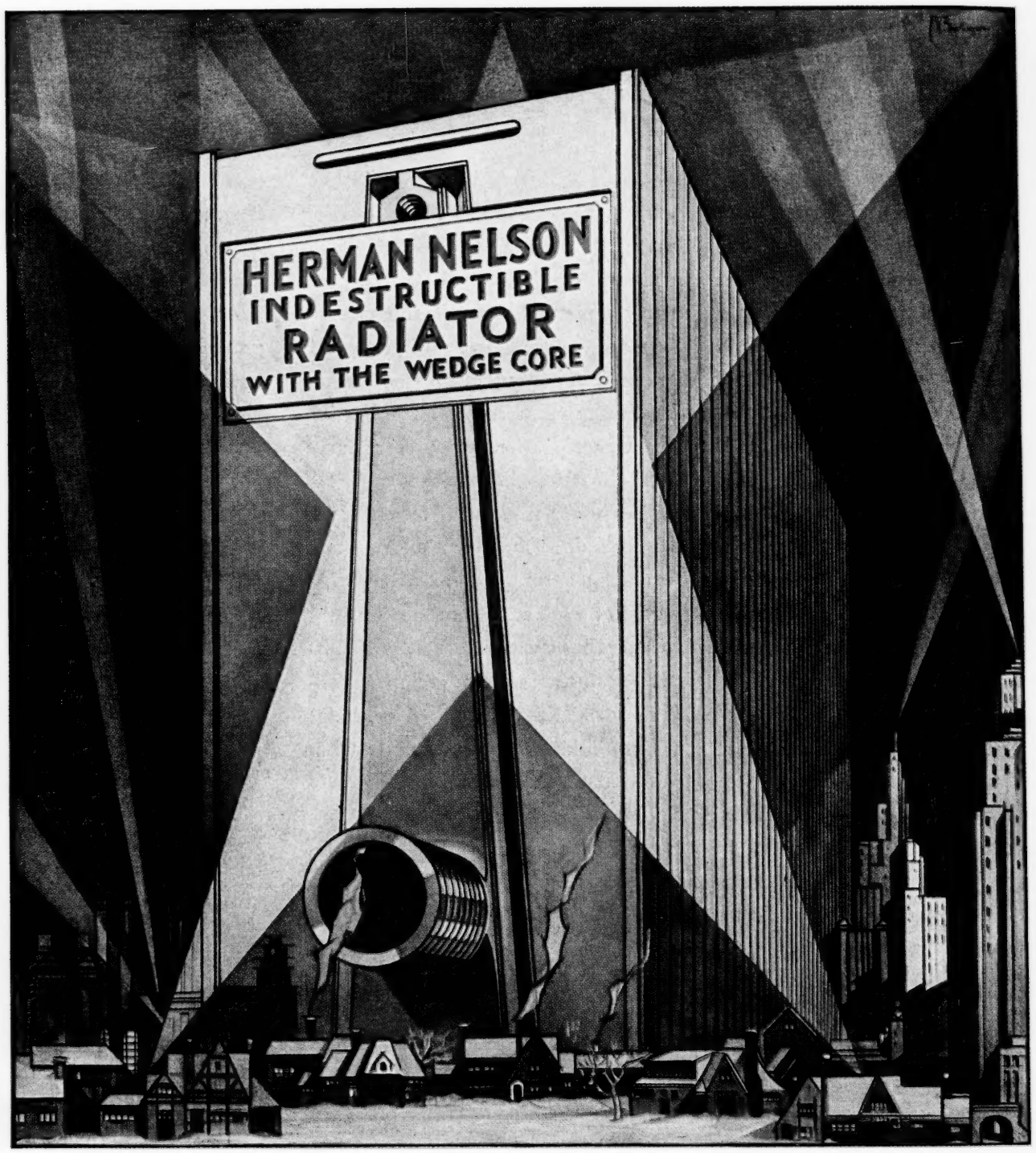
Easy to install

We confidently believe that this radiator is as easy to install as a cast-iron radiator and that you will find it everything you could ask for in the way of appearance, accessibility, cleanliness and—trouble-proof heating results.

While this company has never built down to a price but always up to a standard, large scale production and scientific manufacturing methods bring this new-day radiator well within the economic grasp of all types of buildings.

Behind that grille in the wall . . . there's a radiator that says, "this home is modern."

CORPORATION MOLINE ILLINOIS



OUR CONTRIBUTION TO THE ART OF HEATING AND VENTILATION

The Herman Nelson Wedge Core Radiator is an exclusive feature of all Herman Nelson Heating and Ventilating Products and accounts for their satisfactory performance. ✣ ✣ ✣ THE HERMAN NELSON CORPORATION, Moline, Illinois.

BELFAST, ME.	BUFFALO	CHARLOTTE, N. C.	CINCINNATI	GREEN BAY	MEMPHIS	SALT LAKE CITY	TORONTO
BOSTON	PHILADELPHIA	GRAND RAPIDS	TOLEDO	MINNEAPOLIS	DALLAS	BUTTE	WINNIPEG, MAN.
SPRINGFIELD	SCRANTON	SAGINAW, MICH.	INDIANAPOLIS	DULUTH	OMAHA	SPOKANE	CALGARY
PROVIDENCE, R. I.	HARRISBURG	FLINT, MICH.	CHICAGO	ST. LOUIS	EMPORIA, KAN.	PORTLAND, ORE.	LONDON
NEW YORK CITY	PITTSBURGH	DETROIT	PEORIA, ILL.	BIRMINGHAM	KANSAS CITY	SEATTLE	OSLO
SYRACUSE	JOHNSTOWN, PA.	CLEVELAND	DES MOINES	ATLANTA	TULSA, OKLA.	SAN FRANCISCO	MELBOURNE
ALBANY	WASHINGTON, D. C.	COLUMBUS	MILWAUKEE	NEW ORLEANS	DENVER	VANCOUVER	TOKYO, OSAKA

©1930, T. H. N. Corp.

This 12-inch compound turn was made with two 90° TUBE-TURNS. Only 3 welds were required. . . TUBE-TURNS are lighter, stronger and safer than any other stock fittings because they are *forged from the same material as the pipe in the line.* If you are interested in better, more economical piping, you *need* the facts about TUBE-TURNS.

◆ ◆

Lakeside Hospital, Cleveland, Ohio. . . Buerkel & Co., Inc., of Boston, Engineers. . . The W. B. Van Sickle Co., of Cleveland, Contractors.

What does this suggest TO YOU?

This photograph shows how ANY change in direction—from the simplest angle to the most difficult compound turn—can be made on the job *with TUBE-TURNS,* the stock fittings for pipe welding.

TUBE-TURNS are lighter and stronger than any other stock fitting available today. They cost less than any other fitting of comparable strength. They are installed with only two welds—*each straight across the pipe!*

Short-radius. Non-porous. Uniform in wall-thickness. No buckling, thinning or flattening. Cause less pressure drop. Stocked in all sizes—in 45°, 90° and 180° types—by the distributors listed below. *Write today for full details and prices.*

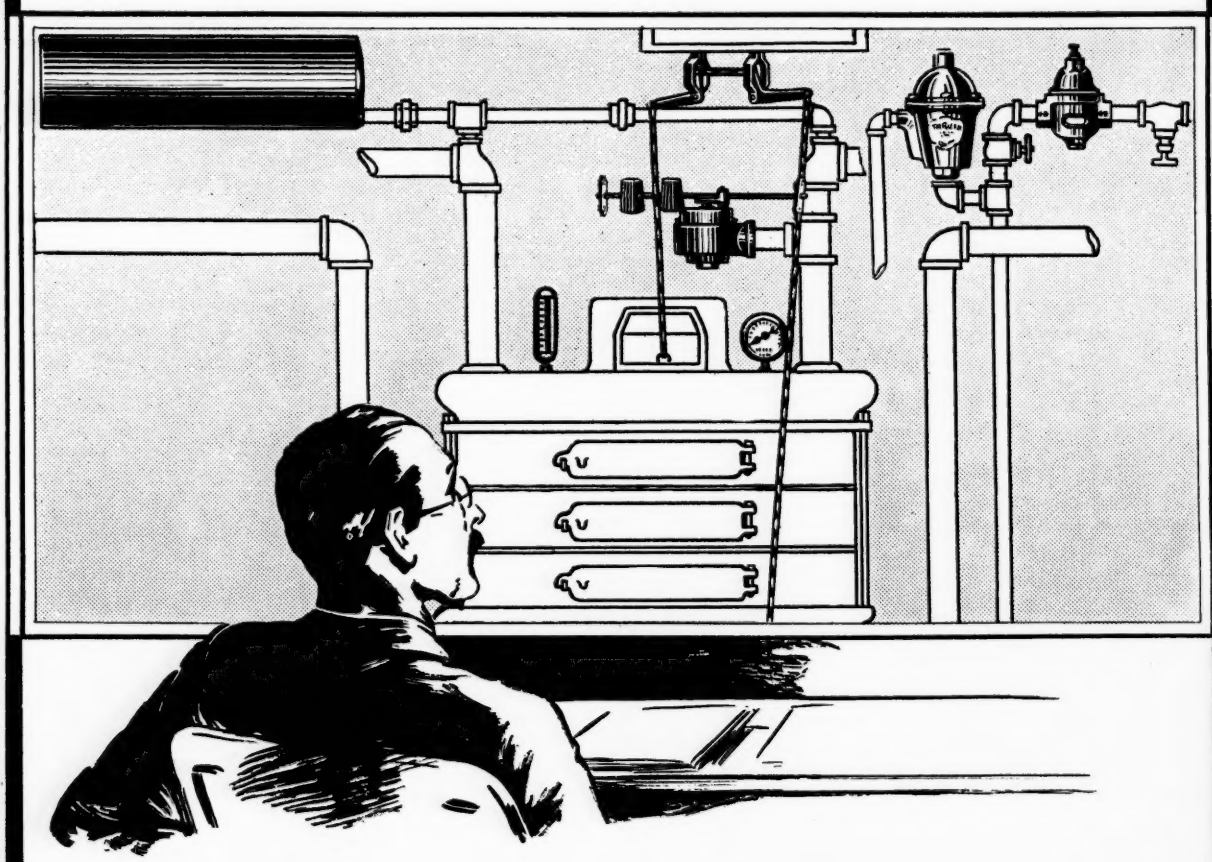
Address:* TUBE-TURNS, *Incorporated
***General Offices:* 1319 Shelby St., Louisville, Ky.**

CHICAGO	NEW YORK	PHILADELPHIA
110 S. Dearborn St.	*30 Church Street*	*Bourse Bldg.*

TUBE-TURNS

DISTRIBUTORS: *Baltimore, Md.,* The Heat and Power Corp. . . . *Cambridge, Mass.,* Baker Supply Co. . . . *Cleveland, O.,* M. S. Maleson Co. . . . *Detroit, Mich.,* C. E. Phillips and Co. . . . *Houston, Tex.,* Maintenance Engineering Corp. . . . *Los Angeles, Cal.,* Buck and Stoddard . . . *Pittsburgh, Pa.,* Herr-Harris Company . . . *St. Louis, Mo.,* H. A. Woodworth Engineering Company . . . *Toledo, Ohio,* Mason Equipment Company . . . *Tulsa, Okla.,* The Moorlane Company *Honolulu,* Hawaiian Gas Products, Ltd.

STUDY THE ADVANTAGES



THRUSH CLASS "AA" SYSTEM OFFERS!

Thrush Electric Circulator is a noiseless, sturdy, long-lived electric circulating pump that will cure sick heating plants and make any job work much better. Try it!

COMPLETELY *automatic control of Hot Water Heating Plants*, a "Closed System" with increased heat transmission and *reduced fuel consumption.* Automatic filling of the boiler, automatic relief of excessive pressures and automatic control of dampers, Thrush Equipment to be placed on old or new jobs *will positively make any heating system work better.*

Thrush Forced Circulation

When the Thrush Electric Circulator is added to Class "AA" System it provides *positive mechanical circulation,* assuring uniform temperatures at all radiators and a further increase in efficiency. Especially desirable on oil or gas fired jobs.

WRITE FOR CIRCULAR

H. A. THRUSH & CO.

Peru, Ind.

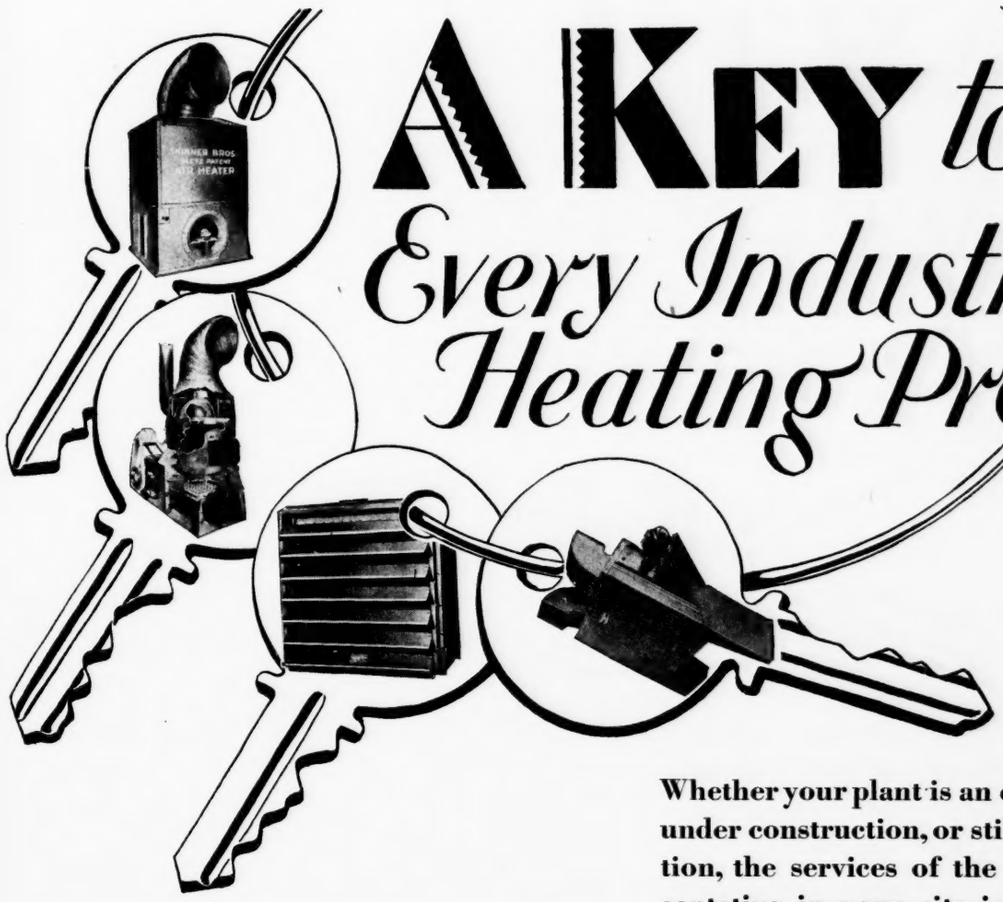
MAIL COUPON NOW!

H. A. THRUSH & CO.,
Dept. A, Peru, Indiana.
Send details of Thrush Class "AA" System and Thrush Electric Circulator.

*Name*_____

*Address*_____

THRUSH SYSTEM
OF HOT WATER HEATING



A KEY to Every Industrial Heating Problem

With Skinner Bros. Unit Heaters no attempt is made to fit one type heater to all conditions. Skinner Bros. manufacture sufficient sizes and types of unit heaters to satisfy any condition or any combination of conditions that arises to complicate the industrial heating problem.

Whether your plant is an established one, under construction, or still in contemplation, the services of the Skinner representative in your city is yours, without obligation, simply for the asking. He will be glad to confer with you, your architect or your contractor regarding heating, ventilating or air-conditioning. Just phone him. . . . Or, if you prefer to investigate Skinner equipment more fully before talking to him, write direct to Skinner Bros. in St. Louis for catalog.

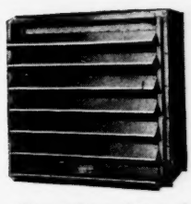
Skinner Bros. Unit Heaters

SKINNER BROS. MANUFACTURING COMPANY, Inc.
1402 S. Vandeventer Avenue, St. Louis, Mo.
Branches in All Principal Cities *"The Originators of Unit Heating"*

A UNIT HEATER FOR EVERY INDUSTRIAL HEATING AND VENTILATING REQUIREMENT

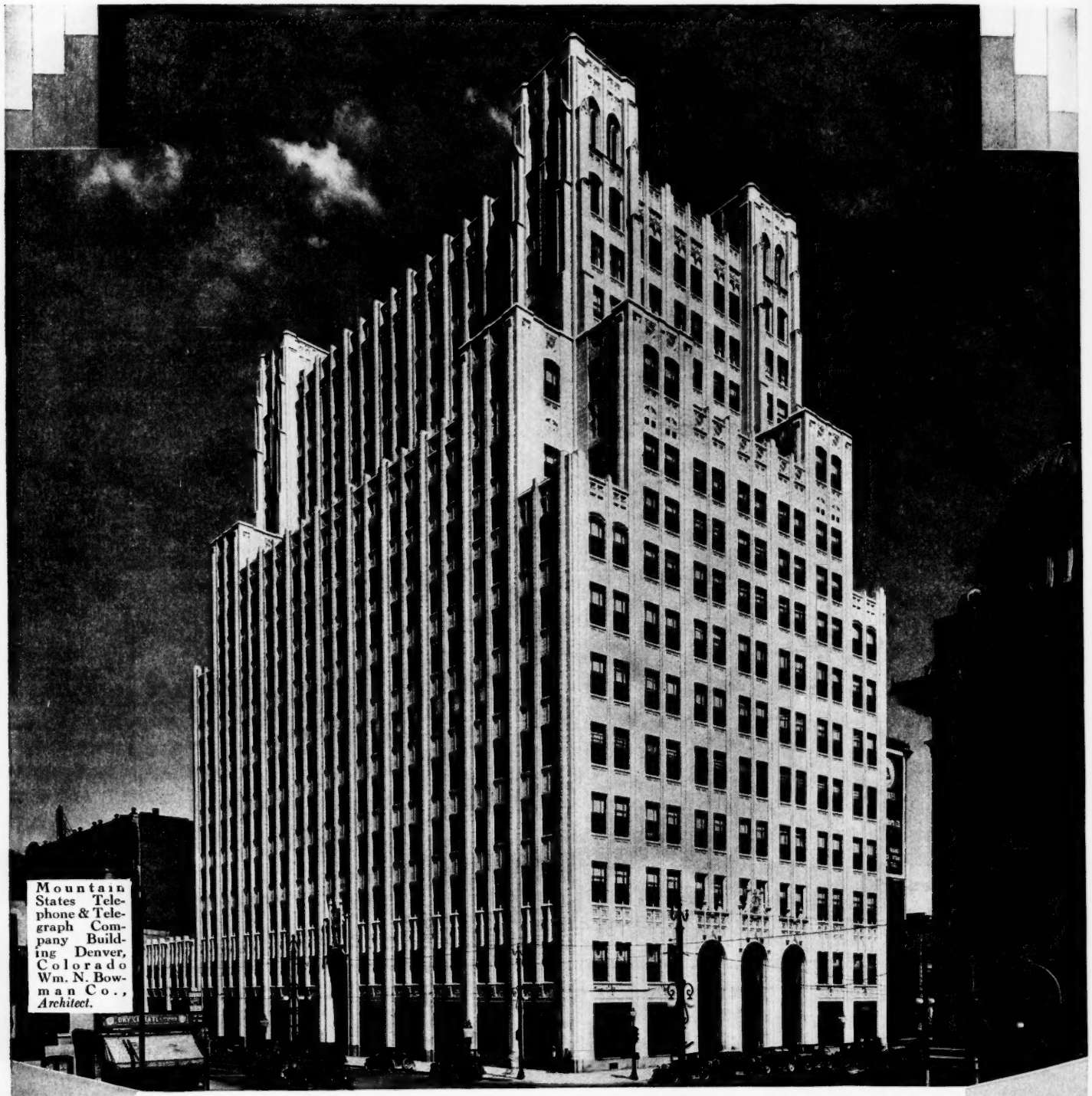
Skinner Bros. "Baetz Patent" Air Heater

Skinner Bros. Patented Direct-Fired Air Heater



Skinner Bros. Patented "Lightweight" Air Heater

Skinner Bros. Type "U" Air Heater



Mountain States Telephone & Telegraph Company Building Denver, Colorado Wm. N. Bowman Co., *Architect.*

Johnson Operation In This Building

All sources of heat and all ventilation apparatus in this building are Johnson Controlled: and is an interesting example of the varying uses of The Johnson System. The basement of the building contains the Cafeteria having a forced fan system of ventilation. The business offices are on the first floor, heated by direct radiation and ventilated by unit ventilators. The second to the fifth floors, inclusive, are the telephone exchange floors—heated and ventilated by means of unit ventilators. Above the fifth floor are the general and private offices. The larger (general) offices are heated by direct radiation and ventilated by unit ventilators. The private offices are not equipped with ventilating apparatus, and are heated by direct radiation. The fifteenth floor includes an auditorium, heated by direct radiation and ventilated by a central fan system. Regulation consists of a combination of constant temperature and dual temperature system: The telephone exchange floors being under the constant temperature system; the remainder of the building under the Dual System—which maintains one temperature for the occupied period and a lower temperature for the unoccupied period. Write now for Johnson details, applied to your building's heating and ventilating.

JOHNSON SERVICE COMPANY *Established 1885* MILWAUKEE, WISCONSIN

JOHNSON HEAT & HUMIDITY CONTROL

Specify

WALWORTH
VALVES
FITTINGS
AND TOOLS

for

PLUMBING
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HEATING

TESTING WALWORTH BRASS FITTINGS

WALWORTH
FLAT BAND
RED
Brass Fittings

Another Quality Line

● A Connecticut builder recently completed a large structure in which thousands of Walworth brass fittings were used. ● Not a single fitting was cast aside on the job; not one leak showed up on test. ● The builder was surprised—but he needn't have been.

● Fittings can't leak on the job when they have been tested with air under water before they leave the factory and when they've been installed by men who know their business. ● Especially when they are made of tough red brass and reinforced with flat bands which give maximum weight and strength at the right spot.

● Of course, we're pleased when Walworth Red Brass fittings prove 100 per cent perfect. But we're not so much surprised. ● We make Walworth Red Brass fittings *for* 100 per cent performance.

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Walworth Company, General Sales Offices: 51 East 42nd St., New York
Plants at Boston, Mass.; Kewanee, Ill.; Greensburg, Pa.; and Attalla, Ala.

. . . Distributors in Principal Cities of the World . . .

Walworth Company Limited, 620 Cathcart St., Montreal, P. Q.
Walworth International Co., New York, Foreign Representative

IT'S JUST AS IF THIS CENTER WERE REMOVED

ALL unit heaters have a core through which the air is blown. The "Free Area" is that percentage of total core area which is free to the passage of air. WINCHESTER Copper Radiators combine a large heat dissipation with a large, free area by their efficient arrangement of heating surface.

WINCHESTER Copper Radiators have 62% free area.* Only 38% of the frontal area is occupied by the metal of the core. This great percentage of free area means that Winchester-equipped unit heaters deliver greater air volume at higher velocities with the same fan and motor equipment.

Any unit heater manufacturer can supply his heaters with WINCHESTER Copper Radiator Cores. It is necessary only to specify" with WINCHESTER Copper Radiating Surface."

*With a Winchester Radiator core 24 inches square this 62% free area means that the fan is virtually blowing air through an unrestricted hole almost 19 inches square and is picking up an enormous amount of heat while doing it.

WINCHESTER
TRADE MARK
COPPER RADIATORS
RADIATOR SALES DIVISION
WINCHESTER REPEATING ARMS CO., NEW HAVEN, CONN., U. S. A.

Enlarge your business without additional investment

A sound plan to increase your profits and amplify your service

The increasing preference for oil heat in your community has developed an opportunity for competent heating contractors to expand their business, broaden their service and add to their income. Electrol is prepared to give the necessary backing for you to cash in on this opportunity.

You do not have to become an oil-burner dealer. You do not have to increase your overhead, or make any investment in equipment. Instead, you make good use of the Electrol dealer's complete sales and service facilities. All the details of installing and servicing are taken care of for you. You simply co-operate as a representative of those clients of yours who are oil-burner prospects. —And you will find that a great many of them are.

You will find that your friends and customers naturally look to you for advice on oil heating. Your professional influence plus Electrol's reputation and the Electrol dealer's full co-operation will be put to work to enlarge your business. Your income will increase as your clients adopt Electrol all-electric, automatic oil heat.

The Electrol dealer nearest you will explain the full details of this money-making proposition. Have a talk with him. Or write us and we will have him get in touch with you.

ELECTROL INCORPORATED
227 East 45th Street New York City

Send for these new bulletins: "The Electrol Oil Burner Is Adaptable to All Types of Heating Systems" and "Household Heat and a Year-Round Hot Water Supply with the Same Electrol Oil Burner" have just been published for the information of heating men. Copies will be mailed free upon request.

Electrol will add to your prestige in the heating profession

When you recommend Electrol to your clients, you have the full backing in organization and resources of the world's largest producer of quality oil burners. The mechanical superiority of the Electrol burner and the recognized caliber of the men who comprise Electrol's management assure the continuance of Electrol leadership . . . a leadership which reflects favorably upon the heating man who recommends Electrol Automatic Oil Heat.

MEMBER OIL HEATING INSTITUTE

ELECTROL

The* OIL BURNER *with the Master Control

LISTED AS STANDARD BY THE UNDERWRITERS' LABORATORIES

Electrol Incorporated,
227 E. 45th Street, New York City, N. Y.

Please send me copies of the two bulletins described in current issue of Heating and Ventilating.

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Address.....

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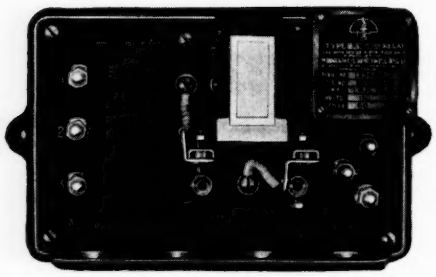
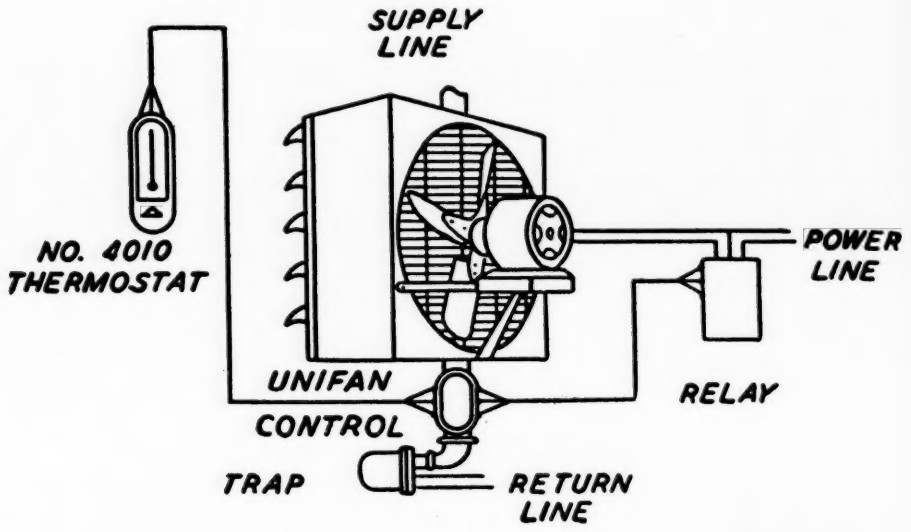
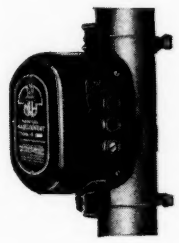


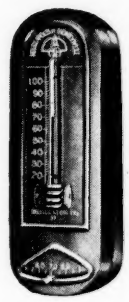


ACCURATE CONTROL OF UNIT HEATERS

— is necessary for greatest economy



Accurately operating temperature controls make the difference between satisfactory and unsatisfactory unit heater installations.



Minneapolis-Honeywell Series 10 low voltage unit heater controls operate on a one degree temperature change.

Plan your unit heater installations with Minneapolis-Honeywell Series 10 controls. There is no better way to insure maximum economy — better working conditions — and all around greater comfort . . . Let us tell you more about Minneapolis-Honeywell control devices, of either the low or high voltage types. Send the coupon.

MINNEAPOLIS
INDUSTRIAL REGULATORS
HONEYWELL

MINNEAPOLIS-HONEYWELL REGULATOR CO.
Executive Offices:
2715 Fourth Ave. So., Minneapolis, Minn.

Factories: Minneapolis, Minn. and Wabash, Ind.

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MINNEAPOLIS-HONEYWELL REGULATOR CO.
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☐ Send me your pamphlet on Unit Heater and Sectional Control Systems.
☐ Have representative call. I understand there is no obligation.

Name _____ Position _____

Company _____

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BALDOR

A BETTER MOTOR

Matched Frame Ball Bearing Motors

ELIMINATE THRUST AND LUBRICATION PROBLEMS

Single Phase *Polyphase* *Direct Current* *Condenser*

Mounting Dimensions the same Regardless of type

A Specially Engineered Motor for Unit Heaters, Fans & Blowers—

With bases for flat mounting or Round Stator for Ring Mounting

Open or Totally Enclosed

Windings for All Standard and Special Current Characteristics

Three Single Phase Types

Split Phase Repulsion Induction Condenser

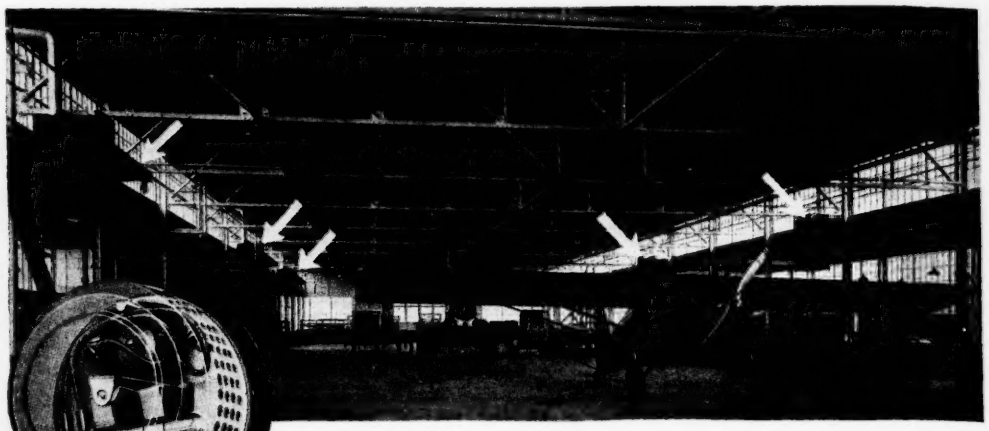
(Constant and Variable speed)

Direct Current Polyphase

Write for detailed illustrated bulletin

BALDOR ELECTRIC COMPANY, 4356 Duncan Ave., St. Louis, Mo.

MERCOID CONTROLS



The above illustration shows the Metal Air Craft Corporation building equipped with "Sterling" gas fired unit heaters which are controlled by Mercoid Thermostats.

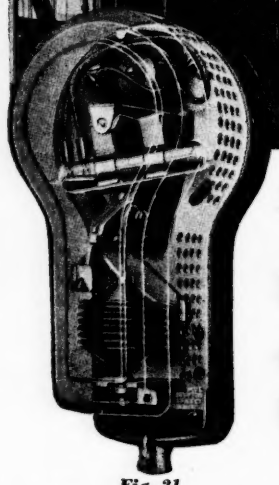


Fig. 21
Mercoid Thermostat

Unit Heaters Plus Mercoid Controls Equal any Predetermined Temperature Requirement

CONTROLLED temperature is a modern necessity. Many manufacturing processes require definite temperatures to facilitate production. There is hardly an industry that would not find it more economical to use Mercoid-controlled heat.

Unit heaters, governed by Mercoid controls, make an ideal combination to meet practically all industrial heating requirements.

The Mercoid Thermostat is well known for its unfailing performance and is extensively used with various makes of unit heaters. It controls the motor directly where the normal working load does not exceed 10 amperes at 110 volts or 5 amperes at 220 volts. As a pilot switch, where used in series with the proper starting switch, the Mercoid Thermostat will automatically control motors of the largest size.

Where dual control is desirable, it may be obtained by using either Mercoid Fig. 31 Pressure Control or Mercoid Fig. 34 Risertherm in combination with the Mercoid Thermostat.

The engineering staff of The Mercoid Corporation is at the service of the Trade. All special problems are given prompt and careful attention.

Let Mercoid meet your control requirements.

Complete Catalog Sent Upon Request—Address Dept. H

THE MERCOID CORPORATION

564 WEST ADAMS STREET, *Chicago, Illinois, U. S. A.*

25 CHURCH STREET
New York, N. Y.

1129 FOLSOM STREET
San Francisco, Calif.

TIME-O-STAT CONTROLS

meet every temperature regulation need

TIME-O-STAT Controls provide complete automatic control of temperature . . . and positive automatic protection . . . for every type of heating system . . . All are accurate, dependable, and easily installed. Write for a catalog of the controls in which you are interested . . . or for information on any problems of automatic control.

TIME-O-STAT AUTOMATIC CONTROLS

TIME-O-STAT CONTROLS COMPANY

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Successor to:

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Manufacturers of AUTOMATIC CONTROLS *for Oil Burners — Gas Burners — Coal Burners — Electric Refrigerators — Furnace Fans — Mechanical Stokers — Industrial Ovens — Ice Machines — Unit Heaters . . . . . also of Sign Flashers — Mercury Switches — Electric Heaters — Corrugated Metal Bellows.*

43 PeerVent Units

Installed in this Massachusetts High School

Levi Warren Jr. High School
Newton, Mass.
Ripley & Le Boutillier—Architects.
Buerkel & Company—Engineers.
James S. Cassidy—Contractor

PeerVent Units should be used not only in schools but in such other public and semi-public buildings as theatres, hotels, department stores, etc., where large numbers of people gather and wherever extreme conditions for heating and ventilating exist.

PeerVent Units installed eighteen years ago still cost little to operate and almost nothing for upkeep. Even these old units are far superior to the central fan system, as each unit, independently operated, eliminates the expense of ventilating unoccupied rooms. Today, PeerVent employs the same basic principles, but recent models are highly refined and improved in construction and mechanical excellence.

Peerless Unit Ventilation Co.
Incorporated
The Pioneers of Unit Ventilation
Bridgeport, Connecticut
Offices in Principal Cities
from Coast to Coast

PeerVent
Heating and Ventilating Units

The BUILDING WORLD of TODAY

—Uses "Spang" Steel Pipe with a confidence born of the sterling performance of many thousands of yesterdays.

If you too would enjoy the economy and satisfaction of this time-tried, time-proved pipe for as many tomorrows, specify "Spang" on your Welded Pipe requisitions,—"the pipe that Time forgets."

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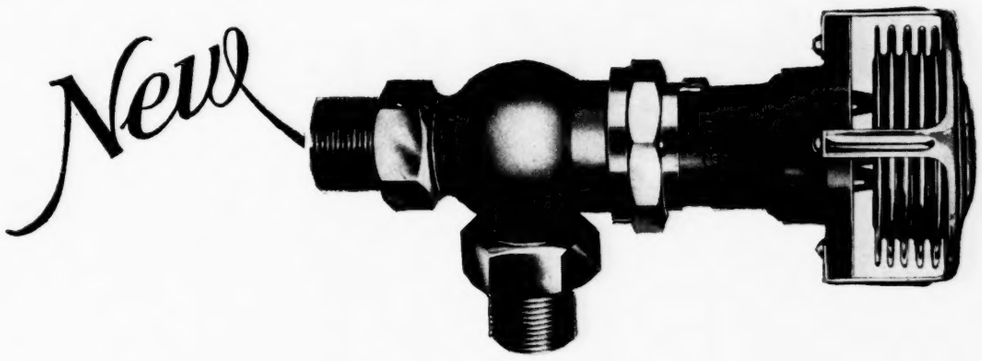
SPANG Welded Steel Pipe

Throw Away your RADIATOR valves!

This advice may sound foolish, but it is the smart thing to do since our new thermostatically operated valve has been placed on the market.

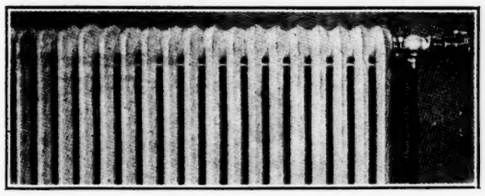
Nobody is conscious of gradual temperature changes until the extremes are reached—very hot or very cold. Rooms left to manual control of its radiators rarely stay at the best temperature to insure health, comfort and fuel economy because of the wide temperature fluctuations.

The new Sylphon Automatic Radiator Valve will keep your room at the desired temperature. You simply turn the head of the valve to the temperature you want and your room remains constant. The saving in heat radiation will more than pay for the small valve cost. Can be used on either old or new installations. Easily installed by any plumber.



Sylphon TRADE MARK

AUTOMATIC Radiator Valves



This Automatic Valve is the newest advancement in the science of heat control. It is simple to install; either on old or new installations.

The Sylphon Automatic Radiator Valve is a self-contained, packless, temperature regulator that does not require compressed air apparatus, electrical conditions to operate it. It is attached to a radiator just like an ordinary radiator valve. To keep down fuel cost by reducing the flow of steam when the desired room temperature has been reached.

Write for detailed literature, Bulletin CH-875. Built by the makers of the famous Sylphon Bellows, largest exclusive manufacturers of temperature control regulators in the world.

FULTON SYLPHON Co.
KNOXVILLE, TENN., U.S.A.

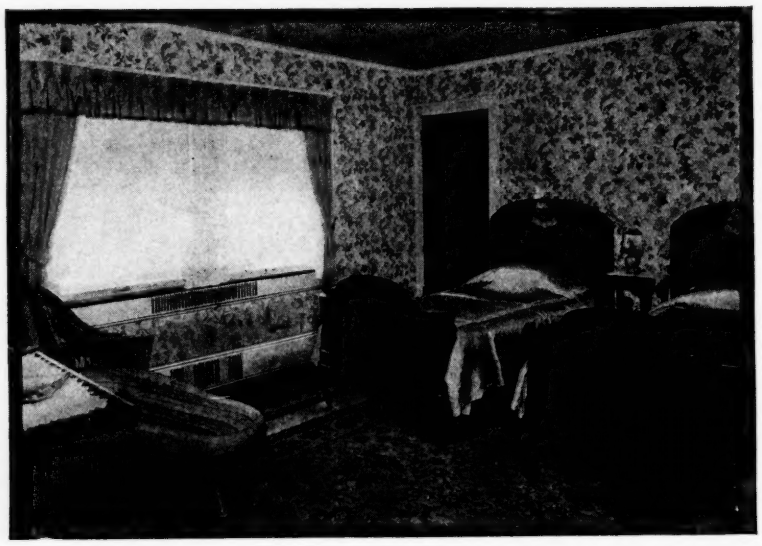
Representatives in all Principal Cities in U. S. A.

European Representatives, Crosby Valve & Eng. Company, Ltd., 41-2 Foley St., London, W. I., England.

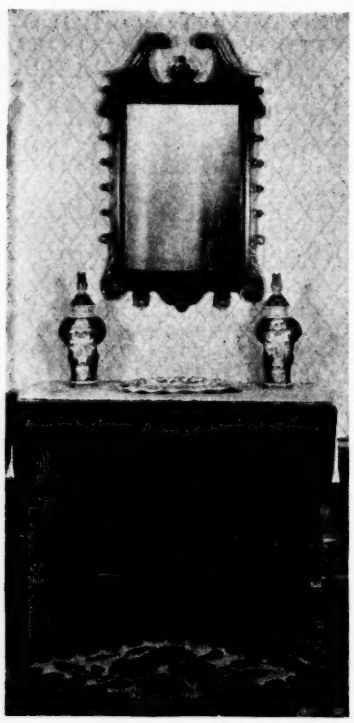
SEE OUR CATALOGUE IN SWEETS

Canadian Representatives, Darling Bros., Ltd., 140 Prince St., Montreal, Que., Canada.

Better Appearance More Economy And Better Heat Distribution



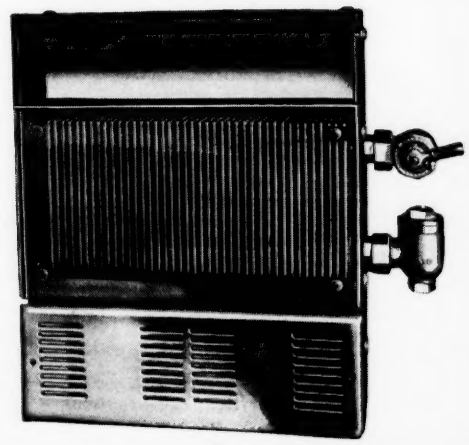
An ideal installation for Aeriet is under windows.



Aeriet helps rather than hinders interior decoration and artistic furnishing arrangement.

Complete detailed information about Air-Way Aeriet is given in a comprehensive booklet which will be sent free to all who request it. Use the coupon on this page and have all the facts about this new heating equipment.

Air-Way
TRADE MARK
AERIET



The new Air-Way Aeriet realizes every desire of the architect and heating engineer. Here is a simple, trouble-proof, super-efficient unit that assures the constant maintenance of any desired temperature in *every part* of any room. It is wholly enclosed within walls or partitions, presenting no unsightly radiators to interfere with interior arrangements. It projects *warmed*—not hot—air out into the room at the living level from which it rises, rather than directly up the walls to the ceiling as with every other domestic heating equipment. No smudge on walls reveals the location of the Aeriet.

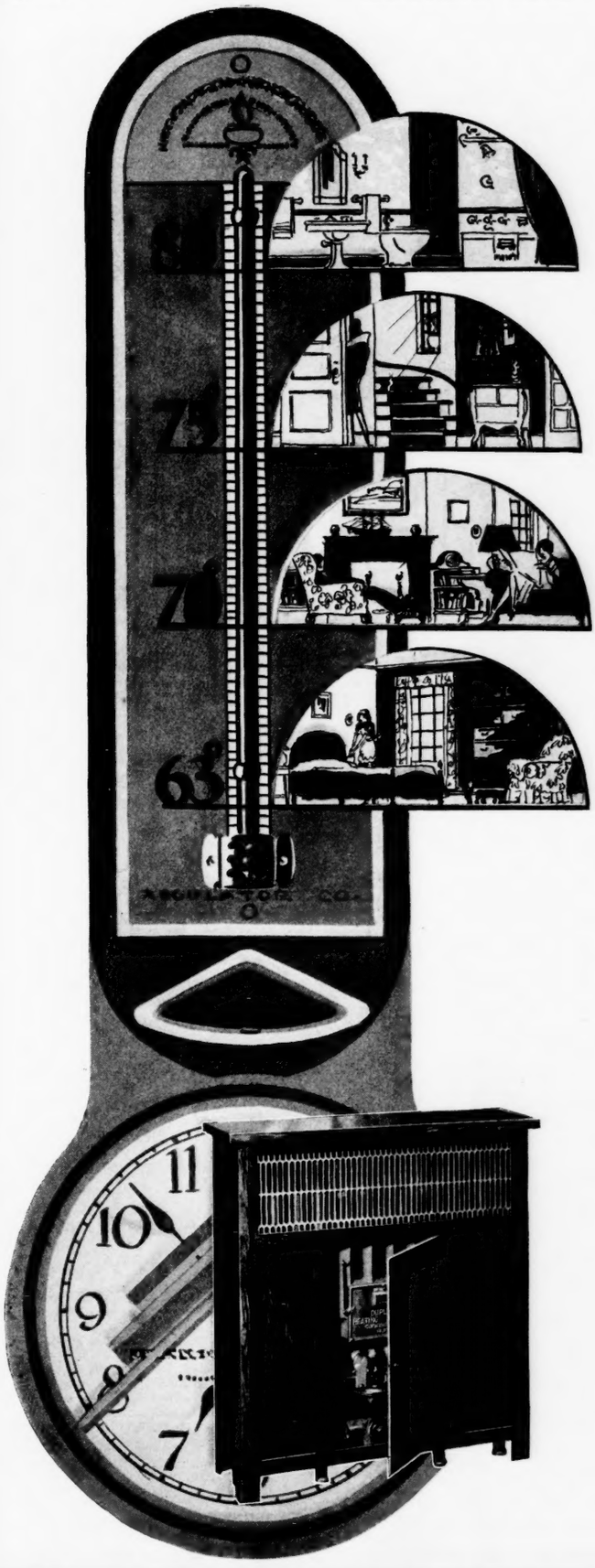
Positive, automatic, thermostatic control in each room eliminates all manual regulation or attention. And yet simplicity of design avoids any necessity for service.

Aeriet is easily installed. Easily removed at any time. It is connected to the usual hot water or steam lines. It is inexpensive in operation. It is the modern domestic heating system.

Please send me the Air-Way Aeriet book.
Name.....
Title.....
Firm.....
Address.....
H & V

AIR-WAY ELECTRIC APPLIANCE CORPORATION

(Heating Systems Division) TOLEDO, OHIO



Sensible temperature

THAT'S the message you can give your customers. Now each room in the home can be heated at any desired temperature. 80 degrees for the bathroom; 75 degrees for the nursery; 70 degrees for the living room; 63 degrees for the unused bedroom. *Sensible temperatures.*

The Duplex Unit Control Gas Heating System sets the pace for comfortable, sensible, economical home heating. How often have your customers asked for a controlled heating system! Now you have the means of satisfying this desire with minimum installation cost and maximum fuel economy.

Learn more about the Duplex System

The complete story is interestingly told in the Duplex Booklet. Use the coupon below and get the facts—for Duplex is the coming heating system. Mail coupon today.

DUPLEX UNIT CONTROL GAS HEATING SYSTEM

Yes, we are interested in the modern method of home temperature control. You may send us the complete Duplex Story, without obligation.

Individual.....

Firm Name.....

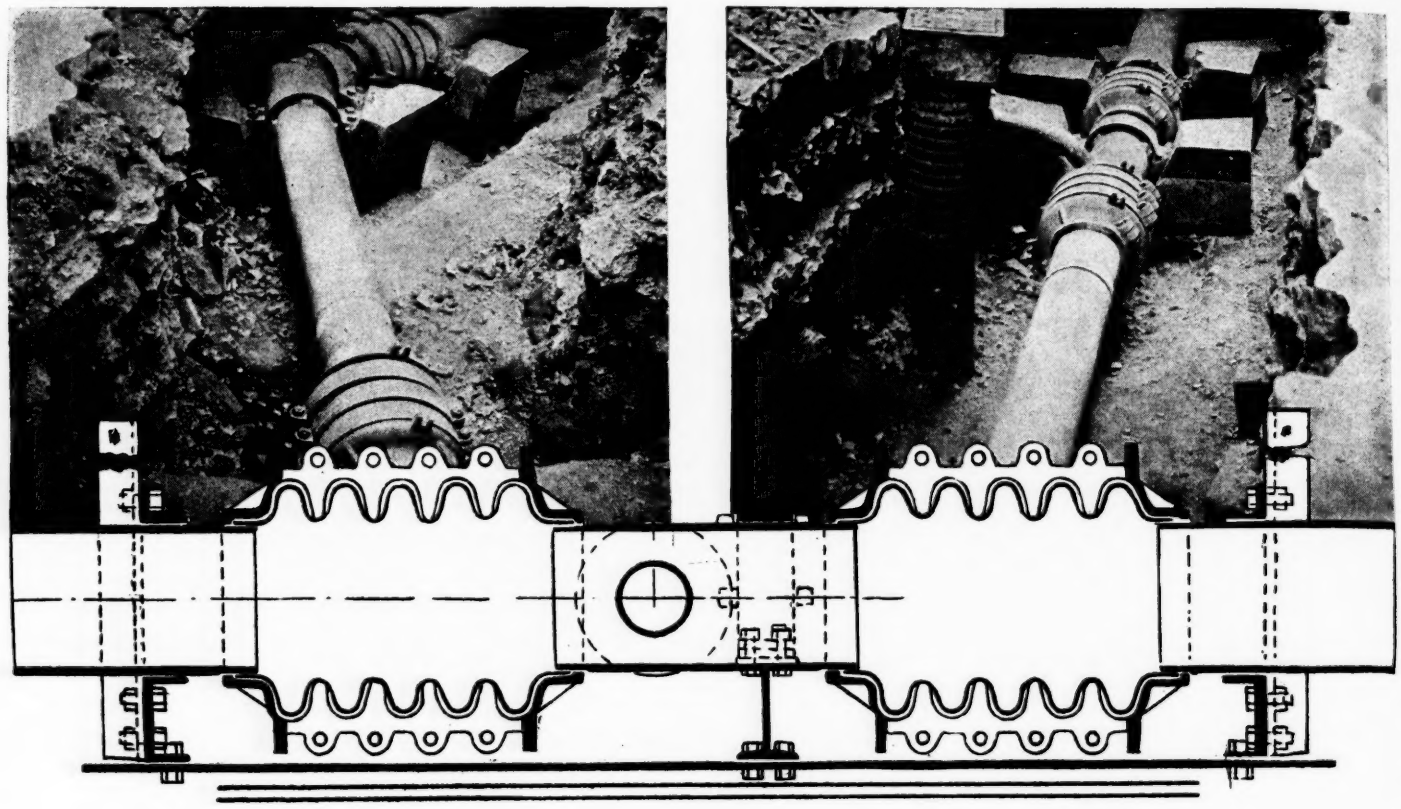
St. Address.....

City.....*State*.....

ROBERTS-GORDON APPLIANCE CORPORATION

DELAWARE AVENUE AT TUPPER STREET

CURTISS BUILDING BUFFALO, N. Y.



Protected Expansion Joints Mean *Protected* Steam Lines

A CORRUGATED seamless tube is the most natural means for taking up expansions and contractions in lines.

Yet some way must be provided to prevent the corrugations from becoming distorted or overstressed.

With Badger Joints, equalizing rings are the preventive. They serve to distribute the stresses thus preventing any one corrugation from flexing beyond a safe point.

Expansion joints so protected mean that the steam lines are protected. This is one reason why Badger joints are so popular.

There is a Badger Joint for every pressure or expansion. There is a joint for every size of pipe.

E. B. BADGER & SONS COMPANY

67 Pitts Street, Boston, Mass.

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Los Angeles, Cal., 517 Hollingsworth Building
Minneapolis, Minn., 716 Build. Exch.
Montreal, Que., Can. Cement Bldg.
New York, N. Y., 271 Madison Ave.
Philadelphia, Pa., 1500 Walnut St.
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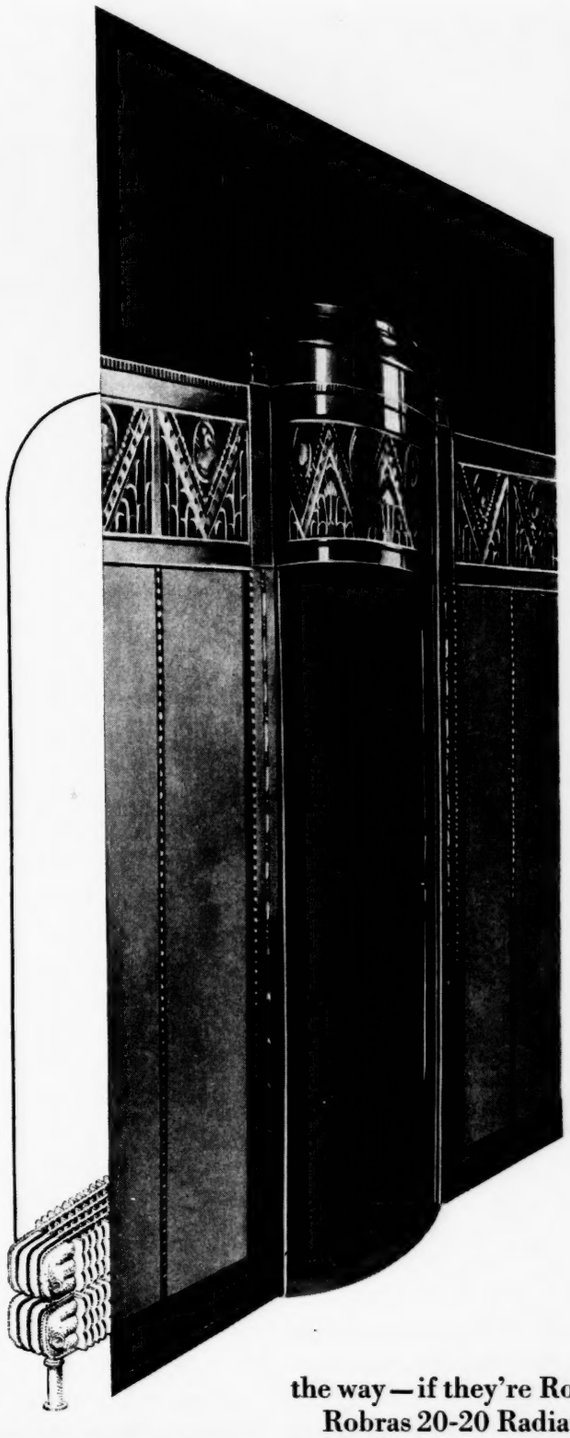
BADGER EXPANSION JOINTS

ESTABLISHED 1841 · WEATHER VANE ON FANEUIL HALL · E. B. BADGER & SONS COMPANY · TRADE MARK



Integrity Trust Building, Philadelphia, Pa. Paul P. Cret, Architect; Isaac H. Francis, Engineer; Charles Monday, Heating Contractor.

Where the radiators went . . .

NO place to put the radiators? Put them *in the walls, out of sight, out of the way.* They're designed to be most efficient when installed that way.

If you've a lobby to equip, (like this one of the Integrity Trust Building, in Philadelphia) put them in the lobby walls. If you've a home to equip, put them in the walls, between the studs, or wherever there's a space 4″ deep. Put them anywhere out of the way—if they're Robras 20-20 Radiators!

Robras 20-20 Radiators are made of brass on entirely new heating principles, are only 20 per cent the size of cast iron! And only 20 per cent the weight! And two men can install four or five times as many in a day as they could working with cast iron radiators.

The rest of the story—with price list and data sheets—is waiting for you. May we send it to you? All we need is your name and your address. ROBRAS 20-20

ROME BRASS RADIATOR CORPORATION, 1 East 42nd Street, New York, N. Y.

Eliminates Densest Smoke In One Minute!

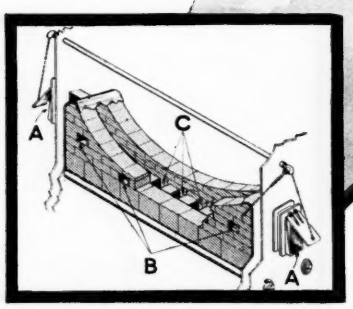
THESE pictures of the chimney on the Father Dempsey Hotel, St. Louis, constitute a record of efficient performance which few, if any, other boilers can equal.

They prove not only how rapidly and perfectly the Heggie-Simplex Boiler eliminates the making of smoke after firing, but also how permanently it maintains smokeless operation.

At 1:00 P. M. the fire was cleaned and twenty scoop shovels of low grade soft coal were added, being thrown on in a manner that would create the maximum of smoke. Immediately the smokeless device of the Heggie-Simplex began to function.

Within a minute all "No. 3" smoke* was gone! A half minute later there remained only a trace of "No. 1." At the end of 2 minutes only a slight haze issued from the chimney. At the end of 3 minutes absolutely all smoke was gone and did not appear again during the remainder of the firing period.

* "No. 3" smoke is that grade of smoke ordinarily termed offensive in city ordinances.



Air is drawn in through intake doors (A). Volatiles arising from the fresh fuel are admitted through ports (B). This inflammable mixture, heated by the hot refractories of the chamber, is ready for instant combustion when it passes through the jets (C) down onto the fire.

The Heggie-Simplex burns any fuel smokelessly because it assures plenty of air—heated air—over the fire. A smoke eliminating device with intake doors on both sides of the boiler admits the additional oxygen essential to smokeless combustion which cannot be drawn through the fuel bed alone. Built of refractories, this chamber heats the air before passing it down onto the fire, where it is thoroughly mixed with the gases.

For complete facts write Heggie-Simplex Boiler Company, Joliet, Ill.; representatives in principal cities—telephone and address listed under "Heggie-Simplex Boilers."

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HEATING AND VENTILATING

formerly

The Heating and Ventilating Magazine

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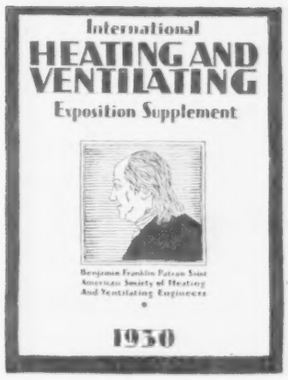

The Exposition Supplement

"I THINK it is only fitting that the officers and members of the American Society of Heating and Ventilating Engineers should express to HEATING AND VENTILATING their appreciation of the International Heating and Ventilating Exposition Supplement, dealing with the exposition. I want personally to express my appreciation of it. The Supplement is filled with news of the exposition and of the convention.

I hope HEATING AND VENTILATING will accept this as the thanks of the society and of the officers for its interest in helping to make our meeting and our exposition a success."—*President Thornton Lewis, at the Wednesday morning session of the A.S.H.V.E., in Philadelphia, last month.*

A. S. Armagnac

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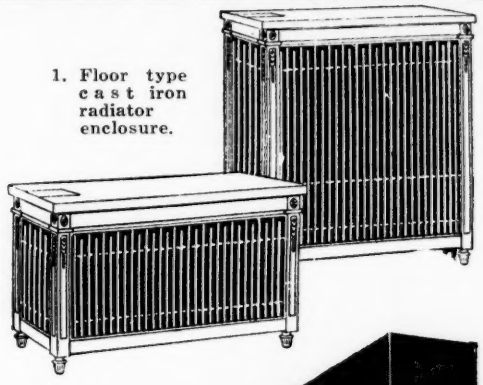

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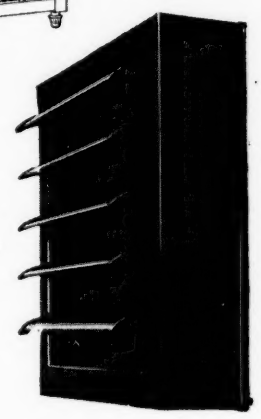
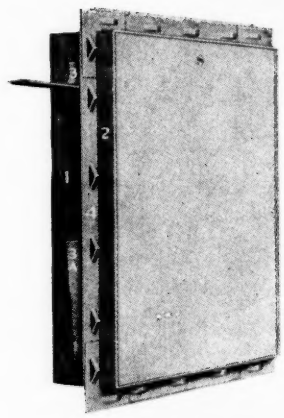
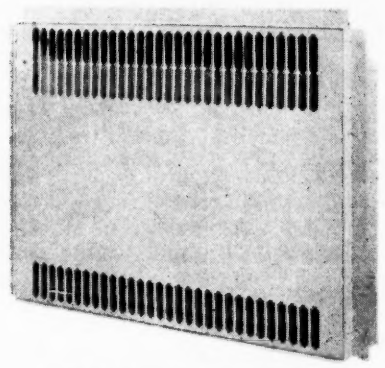


4. Housing for industrial type unit heater.



2. Access Panel Model A showing anchor straps and plaster grabs.



3. Type C J—2 recessed lining and grill for finned radiation.

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HEATING AND VENTILATING

Editorial

LET no one mistake the significance of the event which took place last month at the Commercial Museum in Philadelphia. It will probably always be known as the First International Heating and Ventilating Exposition, but that is not its real name. In reality it was far more than that. It was, in fact, the "Dawn of a New Era in Heating and Ventilating."

It is safe to say that no one connected with the industry had any adequate idea of what was transpiring in Philadelphia until he beheld the exposition in its entirety. It was made up, to be sure, of the usual multiplicity of exhibits. The crowds were the usual crowds to be seen at such shows. What then distinguished it from the ordinary commercial exhibition? Its size, yes, but there was something more. It was the Realization of the Impossible!

"They" said it couldn't be done, that the industry was not large enough or strong enough to strike out for itself in this manner. We all know now that the industry simply had not found its wings.

IT is interesting to recall the history of a separate heating and ventilating exposition. It first was seriously proposed in 1896, and actually was carried out at that time on a small scale. HEATING AND VENTILATING'S reaction to the show was expressed in the comment in our issue for March, 1926, that "if any doubt existed in the minds of the heating and ventilating industry as to whether the industry is big enough to maintain its own show, this doubt was dispelled by the success achieved by the First National Heating and Ventilating Exposition, held in the new Madison Square Garden, New York, March 17-23, 1926. It was not a large show, as shows go, but what there was of it was snappy and interesting."

Later the idea developed of adding a "Heating and Ventilating Section" to the Power Show in New York and labeling it as such. It was an interesting attempt but, as HEATING AND VENTILATING said after the event, in January, 1927:

"Two facts stand out prominently as the result of the effort to incorporate a heating and ventilating show in a power exposition. One is that the industry has grown to proportions but little appreciated by outsiders and not wholly realized even by the old-line firms in the business. The other is that any attempt to attach a heating show to that of any other industry won't work. It won't work because their lines are bound to diverge almost from the start. The more progress in the art, the greater the divergence. They talk in different terms, they speak a different language. In short, they don't mix.

"Whatever may transpire this year or next it is becoming as plain as day that the heating and ventilating industry will have, and by rights should have, an exposition of its own, devoted exclusively to the advances in this particular field. The industry has the importance, it has the strength and it has the 'goods' to put over its own show in a big way."

When the announcement was made that the A. S. H. V. E. was to sponsor a heating and ventilating exposition in Philadelphia in 1930, HEATING AND VENTILATING expressed its gratification with the comment:

"We predict that the exposition will be a glorious success and that it will attract great throngs of engineers, contractors, scientists and health officials, to say nothing of the lay public, which will have the awakening of its life in discovering the comforts, yes, the luxuries, the industry has to offer."

And so the dream has come true! Official figures, compiled by the exposition management of the Philadelphia show, bring the total number of visitors to over 50,000 people and these figures do not include the hundreds of visitors who had season or exhibitors' passes.

HOW to estimate the effect of the exposition? The uniformly favorable comments of the exhibitors are one criterion. That, however, is only half the story. What is more important is the reaction the exposition has exerted on us all. We are awake now to the fact that as a class we are Somebody with a big S. Never again will the heating and ventilating industry underrate its importance. Never again will the industry hesitate to take its place in the sun, instead of following on in the wake of some larger body. It has taken the plunge and knows now that the water is fine. That is the big thing that has come out of the exposition.

Making the Survey for th

UP to the past few years, experience of heating contractors with oil burners has proven anything but profitable to them. There are certain causes and effects which insure profit in any operation. An operation is profitable only in so far as the results obtained make for satisfaction to the purchaser and also to those responsible for the operation.

"Cooperation" is a word that means a great deal to both the heating contractor and the manufacturer of the oil burner. The manufacturer is entitled to a certain amount of loyalty from the heating contractor, and also responsibility for and assurance of an installation that will give satisfaction.

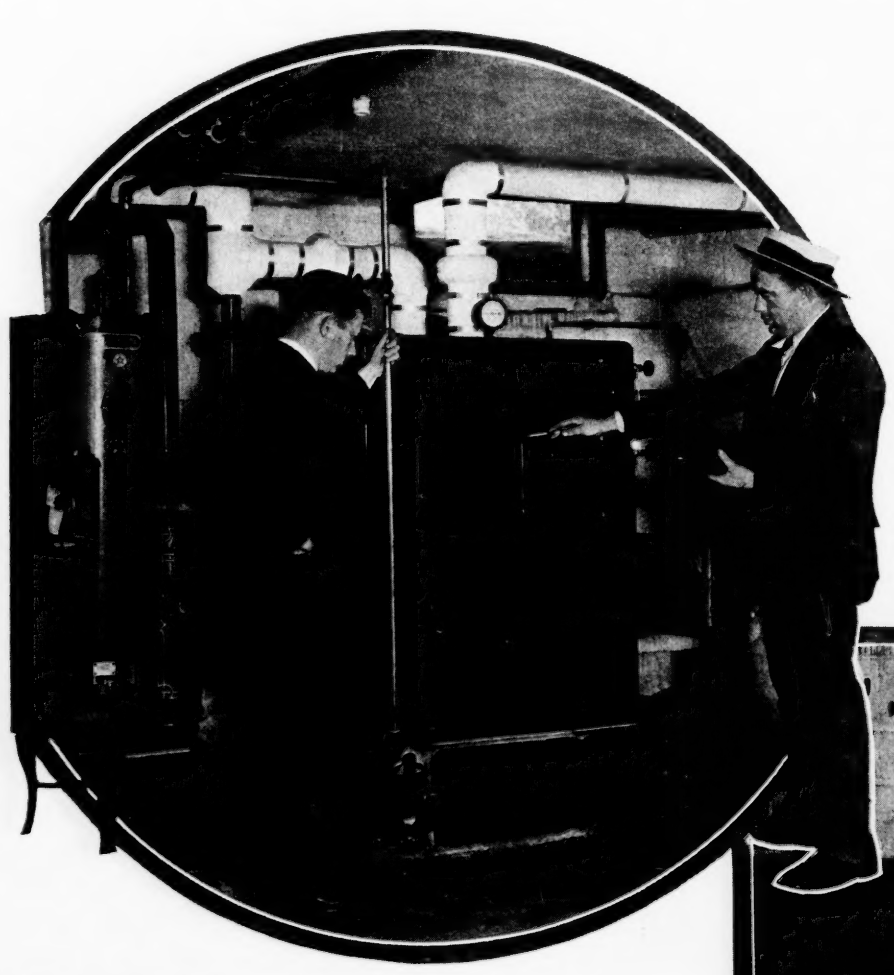
The heating contractor also is entitled to constant advice from the manufacturer, who on account of his wide experience, has access to proven successful methods used by progressive retail distributors, both for his product and those of other manufacturers. The manufacturer should pass along to the heating contractor, through letters, bulletins, contact with factory representatives and all other means available, all advice naturally given by a successful sales manager to his salesmen, for after all the heating contractor and the dealer are the salesmen of the manufacturer.

Profit accrues to the entire oil-burner industry through progressive dealers. The progressive dealer demonstrates the possibilities of complete cooperation between dealer and manufacturer. Both dealer and manufacturer—the dealer at this stage is the heating contractor—have definite plans to follow in stimulating the installations of oil heat.

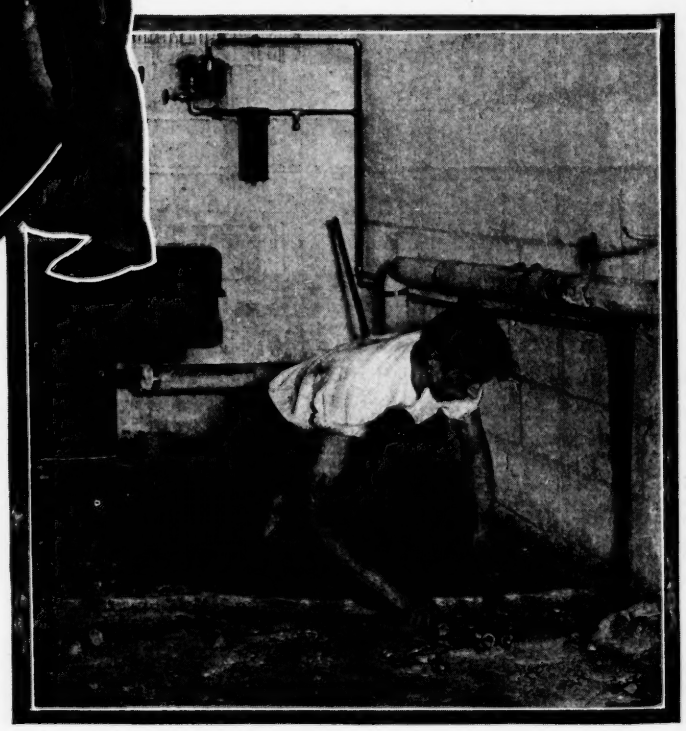
Manufacturers must have a burner certain to give satisfaction when properly installed. They must do their part to interest the public in automatic oil heat. This job has been fairly well accomplished and today automatic oil heat is desired by the average home-owner.

It is the job of the dealer and heating contractor to turn these desires, created by national and direct mail advertising, into definite orders. Turning prospects into oil-burner owners is but one part of the job.

Before complete heating satisfaction may be assured, a survey must be made. The manufacturer's engineering department previously will have outlined certain rules and cer-



The Dealer Must Have a Thorough Knowledge of All Types of Boilers and Heating Systems in Order to Make the Proper Layout.



High Grade Pipe Fitters Should Be Maintained by the Dealer So that Skill May Be Employed in Laying Oil Pipe Lines.

the Oil-Burner Installation

by **J. P. FEELEY**

Assistant to the General Manager, Electrol, Inc.

tain methods that must be used in analyzing and performing the survey. There are any number of meanings for the word "survey." We now realize that the word "survey" has been accepted as a part of the manufacturer's code, and if the survey is properly performed, the results will be beneficial both to the manufacturer and the heating contractor, the latter of whom is acting in a great many cases as the dealer.

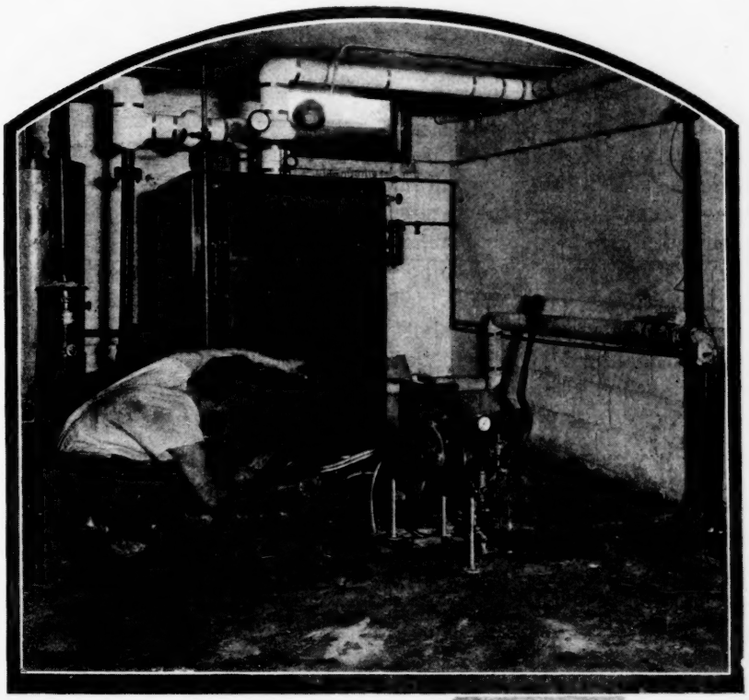
There are three factors that enter the survey:

1. Survey of the outside premises for location of the tank, fill pipe, vent pipe, accessibility for the delivery of oil, and also with respect to the lawn, shrubbery, walks and driveways.

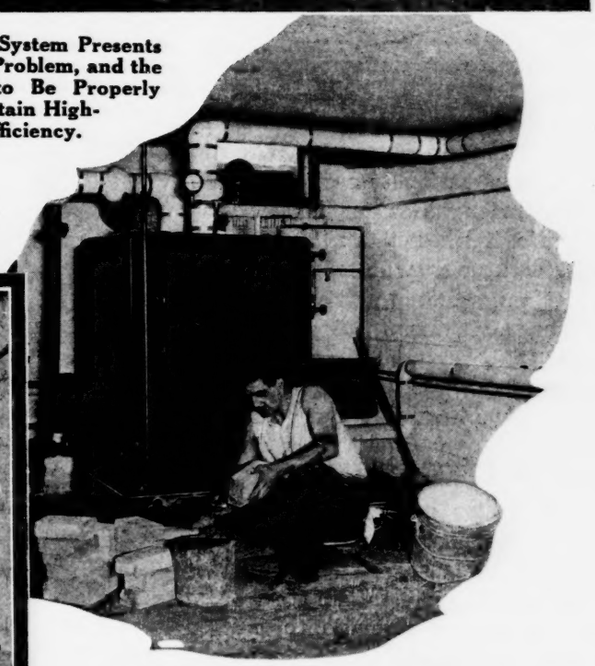
2. Survey of the heating plant in reference to capacity and heating requirements.

3. Survey of the electrical equipment, such as installation of the thermostat, location of the Square D Switch, running of wires and their location relative to cutting through partitions or crossing beams, etc.

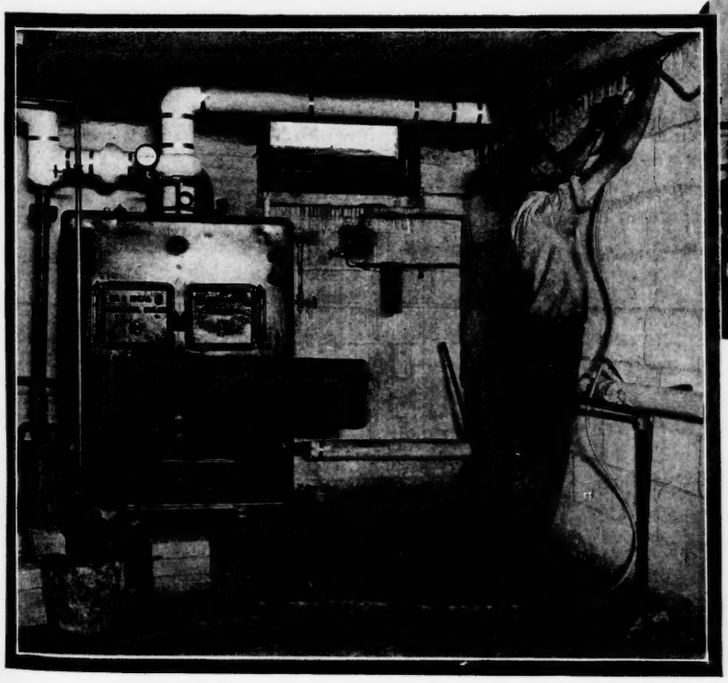
Location of the tank is very important, and this is one item of the survey that must receive the full assent of the future owner of the oil burner installation. If the tank location is not surveyed, the owner



Each Heating System Presents an Individual Problem, and the Burner Has to Be Properly Applied to Obtain Highest Heating Efficiency.



The Dealer and His Organization Must Understand the Principles of Combustion and Their Application in Converting each Boiler to Oil Burning.



Neat and Careful Electricians, Experienced in the Special Electrical Circuits, Are Required in Oil-Burner Installations.

considered and his ideas followed, serious difficulty will arise as soon as the tank is installed. Experience proves that the tank survey should be viewed from a critical standpoint, and before any movement is made the survey sheet should be submitted to the owner for his approval. In this way the tank installation will be made satisfactorily and the owner will be in sympathy with all parts of the outside work.

All phases of the survey are important, and no single item should be overlooked. First, when the engineer arrives on the scene, he should have with him a survey blank. This survey blank may be developed according to his company's ideas, or better still a survey form sheet may be obtained from the manufacturer who has spent much time assembling in proper form those items which cover all the desired information.

In the sale of oil-burning equipment, profits are possible only when the installation meets with the owner's demands. In meeting the owner's demands, material, labor and engineering must be considered. Completed installations, in the majority of cases, are not satisfactory unless the survey covering the engineering feature is given first consideration. Every dealer will agree that the conditions surrounding each installation are different. If the installation does not meet the conditions under which the burner must operate, it will not function properly and eventually will cause considerable annoyance to the purchaser, dealer and manufacturer. Therefore, to be assured that all factors pertaining to any particular installation have been taken into consideration, the survey must be efficiently performed.

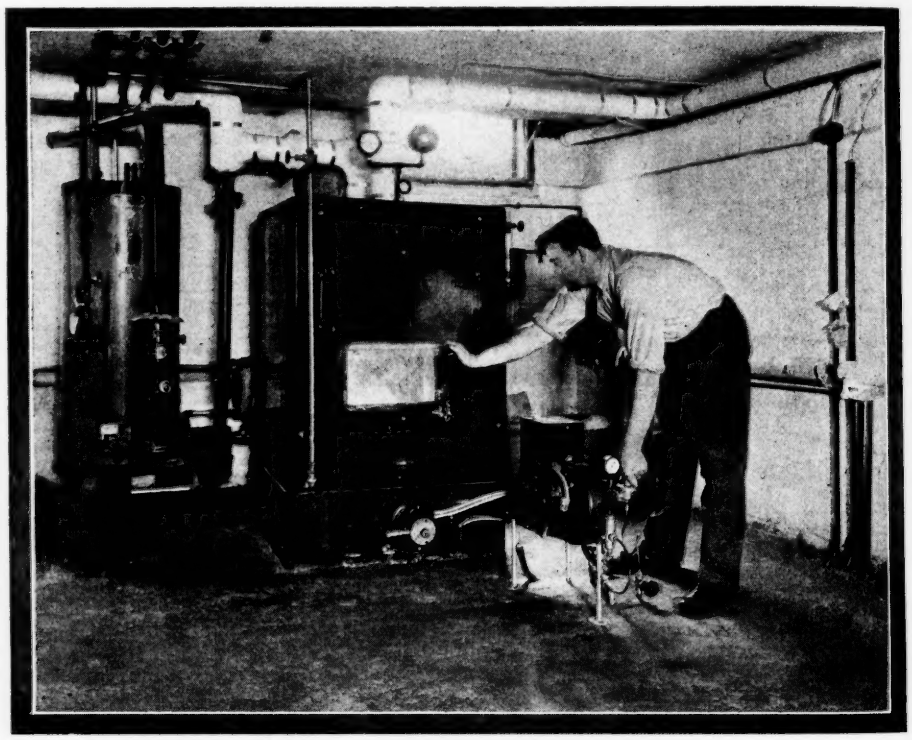
The boiler must be of sufficient rating to supply heat for the total radiation area, necessary to heat the building adequately. An item often overlooked is the relation of fire or boiler heating surface to the standing cast-iron radiation. The correct ratio is problematical, but a safe rule to follow is to assume 5 to 6 sq. ft. of boiler heating surface to 1 sq. ft. of cast-iron steam radiation. In checking and comparing fire surface against cast-iron radiation, there are two items that must be considered, the Direct boiler heating surface and the Indirect boiler heating surface.

Direct boiler heating surface may be defined as the surface which receives the radiant heat or the energy of the flame; in other words, that surface of the boiler upon which the fire shines. Indirect heating surface is that surface on which the fire does not shine, but with which the hot gases come in contact before they pass into the smoke pipe. The ratio of boiler heating surface to grate surface is approximately 30 to 1. One square foot of grate surface will liberate heat units to supply 30 sq. ft. of heating surface.

Many oil-burner installations prove defective, due to the fact that the survey does not show the proper relation between heating surface and cast-iron radiation. It is impossible to get results unless you have enough heating surface.

A great many contractors feel that they can do tricks with an oil burner that will increase the efficiency of the plant. If the plant is sick, that is, if it has not sufficient heating surface to properly supply its radiation load, the oil burner is not going to correct the defect. The chances are that the plant which will not heat properly with coal will not heat properly with oil. A great many heating plants, especially of the specialative type where a large fire-box and possibly one intermediate section and the dome, are used, always cause trouble for the oil-burner contractor, due to poor efficiency and high oil consumption.

When the contractor comes in contact with this particular type heating plant he must explain to the owner that more sections are to be added to the boiler, or that the proper size boiler for that particular home must be installed. If the owner cannot be convinced, it is good policy for the dealer to have nothing to do with that particular oil-burner installation. If his competitor makes the installation, it will not be satisfactory, and the competitor is in difficulty, whereas the contractor who refused the job is looked up to as a man that understands his business.

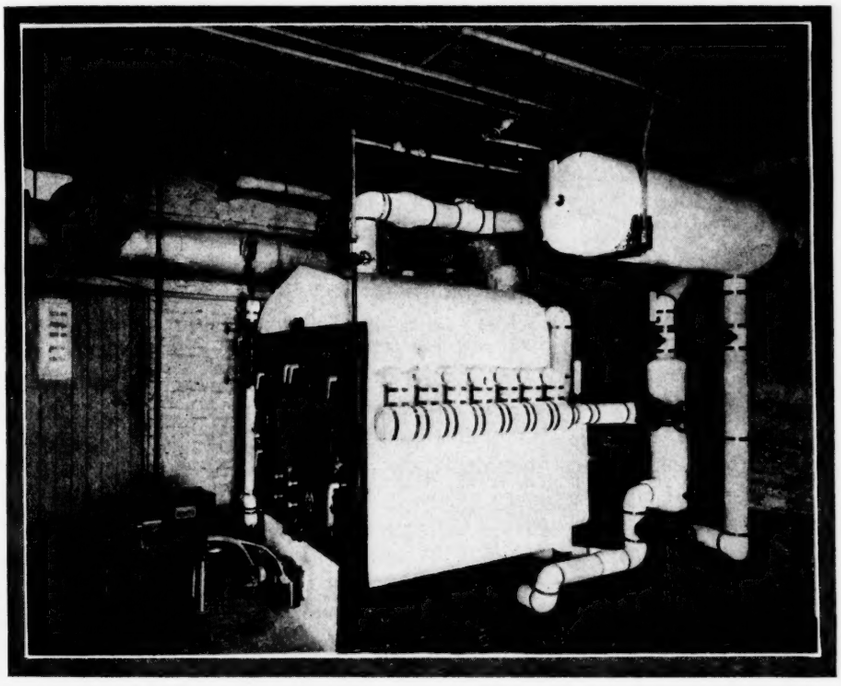


Every Part of the Burner Should Be Understood by the Dealer, and in Order to Maintain Maximum Economy He Must Be Able to Adjust the Entire Installation

It is also important that all pipe lines be checked over for leaks, pitch and proper size as well as the radiation in each individual room. Each manufacturer will be glad to submit sufficient data to the oil-burner dealer, so that he may make this survey, checking the boiler, the piping equipment and radiation. If the dealer follows these instructions, he will not get into difficulty. Over-radiation in one room and under-radiation in another room always

causes trouble, and the cost is the same as with the radiation properly distributed.

There is another item that enters into the survey which is now receiving more consideration than ever before on the part of the owners of domestic oil-burner installations and that is heating domestic water by the indirect method. This system of hot water supply is usually called an indirect water heating system, involving the use of a cast-iron shell and copper tubes. The water, or steam in the boiler, circulates through the shell, transferring its heat to the water in the coils and then to the water supply tank.



Example of a Sectional Boiler Properly Piped for Summer Hot Water Supply from the Oil Burner

There are any number of these indirect heaters on the market, and the particular point that should be considered in the survey is the size of the indirect heater, also taking into consideration that the size of the storage tank adds an extra load to the heating plant and directly increases the oil consumption. It is good practice to allow 2 sq. ft. of steam radiation for each gallon capacity of the storage tank.

Nearly all of the many manufacturers of these indirect heaters base their capacities upon a 100° temperature rise in 3 hrs. This rating is based upon the use of coal for fuel in the heating boiler or furnace and must not be confused by the engineer making the survey with the use of oil as a fuel.

To properly understand the difference between the application of coal and oil, it is necessary to define and clearly understand the existing difference between the method of fuel consumption and its relation to the fire surface. In burning coal, the application of the heating units is slow. Approximately two-thirds of the absorption is in the water legs of the heating boiler and one-third in the crown sheet. With oil as a fuel, a quicker application of heat units is obtained which changes the flow of hot gases through the sections of the heating boiler; then only approximately one-third is absorbed by the water legs and two-thirds by the crown sheet, making due allowances for lost heat units because of the difference in the efficiency of the fuels.

We find that certain factors must be considered and proper allowances made when an indirect heater is installed in conjunction with an oil burner. Due to the relatively slow application of heat when burning solid fuel, a certain amount of heat is generated at all times and is transmitted to the hot water coils, especially when the fire is banked or the drafts checked. This usually maintains an adequate supply of hot water in the storage tank provided the storage tank is of proper capacity.

When burning oil, unless proper provision is made, the operation of the plant depends upon the temperature maintained in the home, and during certain seasons of the year, when the oil burner operates only three hours out of the twenty-four, the house is without hot water. To take care of this, it is necessary to install an indirect heater of greater capacity. Experience shows that the heater should be increased 300% in size over that used when coal is the fuel. This reduces the 100° temperature rise to 1 hr. instead of 3 hrs.

An improper size of indirect heater usually causes the oil burner dealer a great deal of excess service and also the loss of sales, due to an unsatisfactory installation.

In the event that there is no one in the contractor's organization qualified properly to survey for the indirect heating system, a copy of the survey sheet, showing the size and location of the indirect heater that was used when coal was the fuel, the size of the storage tank, and all details connected with the heating system should be forwarded to the manufacturer's engineering department and they will no doubt be pleased to submit detailed drawings and information to assure the dealer that an adequate supply of domestic hot water will be available at all times.

If the engineer making the survey will follow the suggestions outlined in this article, little trouble will be encountered, provided the usual care is maintained in doing the mechanical work necessary.

If the survey is properly made and the installation completed in a satisfactory manner, very little service will be required, and experience proves that a poor burner properly installed is a much more satisfactory installation than a good burner poorly installed. It has been said, and truthfully so, that no company is, or ever will be, capable of achievement beyond its faith in itself. This axiom, taken commercially, implies that no oil-burner company will grow beyond the thoroughness and application that it applies to the survey and installation of the domestic oil burner.

New Facts in the School Ventilation Controversy

by **THOMAS J. DUFFIELD**

Director, Ventilation Research Service, New York, Formerly Executive Secretary and Director of Field Studies of the New York Commission on Ventilation

ONE of the canards that has strutted about the scene of school ventilation discussions since the publication of the report of the New York State Commission on Ventilation, in 1923, is the statement that systems of mechanical ventilation of classrooms are productive of higher rates of respiratory illness among the pupils than are simpler methods of natural ventilation, with window supply and gravity exhaust.

Writers who have exploited this idea have based their conclusions, almost without exception, on the study made under the auspices of the Division of Child Hygiene of the Department of Health of the City of New York, although they probably will not recognize it from this description, with the assistance of the New York State Commission on Ventilation, in specially-selected classrooms in eight and twelve schools, respectively, in New York City, during the spring of 1916 and the autumn and winter months of the first term of 1916-17.

Perhaps one reason for this is the fact that school hygiene is receiving a lot of attention these days and, until recently, there has been little other information on the subject of school ventilation available. Another reason, undoubtedly, is that the explanations offered in support of the conclusions reached by the commission as a result of this study, were contrary to popular belief, and thus have a constantly-recurring news value.

Thus, Dr. Donald A. Laird, director of the Colgate Psychological Laboratory, writing in *Scientific American* for January, 1930, on the subject of "Air" tells us:

"In observations on 5,500 school children under different air conditions, for example, it was found that those spending the school day in rooms with temperatures from 59° to 67° had 70% fewer colds than pupils of the same age and status who were in mechanically-ventilated rooms with a temperature from 68° to 69°. The children with fewer colds were in the colder rooms, and in the rooms with only natural window ventilation."

Editor's Note: As HEATING AND VENTILATING goes to press we learn that Mr. Duffield has accepted the appointment as Executive Secretary of the Committee on Research of the A.S.H.V.E.

The study in question, it will be recalled, was reported by Dr. S. Josephine Baker, then director of the division. As Doctor Baker stated in her report, ". . . the Commission . . . . had full control of the selection of the classrooms with reference to the type of ventilation to be included, the preparation of the forms for recording observations relating to ventilation, the supervision of methods used in obtaining all data on ventilation. The Bureau of Child Hygiene had supervision of all other details of the plan."

These studies covered periods of eight weeks in the spring of 1916, and of twelve weeks during the autumn and winter of 1916-17, and included window and (or) fan-ventilated classrooms in eight and twelve schools, respectively. The incidence of respiratory illness among the pupils was taken as the criterion for judging the effects of the air conditions upon the health of the pupils. The results were calculated by summarizing the units of exposure (pupil-sessions), the number of absences reported due to respiratory illness, and the number of sessions attended by pupils showing evidence (in the opinions of the nurses who made daily examinations) of such illness, and determining the rates of absenteeism, etc., per 1,000 pupil-sessions included in the experience.

These results were stated by the Commission (Page 450 of its report) in the following terms:

"The two periods of this study are in substantial agreement in showing the greatest amount of respiratory illness in the fan-ventilated rooms. No significant distinction appeared as between the two types of window ventilated rooms with gravity exhaust, in spite of a difference in temperature of 6°-7°F.

"The analysis of the complete investigation, after equalizing the influences executed by each school, suggests that fan-ventilated rooms of the type represented in this study, kept at temperatures averaging between 68° and 69°F., are productive of an excessive amount of respiratory illness as compared with rooms ventilated by windows and gravity exhaust kept at 66° to 67°F. The absence rate from respiratory illness in the fan rooms is 11.1 as against 9.4 for the window rooms. The illness rates among pupils present in school is 73 for the fan rooms as against 43 for the window rooms.

"Expressed in the form of a ratio, for every 100 absences from this cause in the window rooms, there are 118 absences in the fan rooms, or an excess of 18%. For every 100 illnesses among those present in the window rooms, there are 170 in the fan rooms, an excess of 70%."

From the foregoing, it is seen that the discussion has been narrowed down to window-gravity vs. fan-ventilation, in rooms with moderate temperature.

When two years of school ventilation studies (1926-1928), of the revived Commission in Syracuse and Cattaraugus County, New York, did not entirely confirm the conclusions of the earlier studies, the writer reviewed the reports of those early studies and presented his findings to the Commission at their meetings in November and December, 1928. His suggestions were rejected, but in the interest of scientific truth and for the peace of mind of those school boards, architects and engineers who might fear that in specifying mechanical ventilation of schools they are endangering the health of the pupils, and to reassure parents who are forced to send their children to mechanically-ventilated schools, those findings are presented here in summarized form at this time.

Stated briefly, there is no evidence that the higher rates of respiratory illness, reported from the fan-ventilated rooms in the school ventilation studies in New York City schools during 1916 and 1917, were due either to the type of ventilation or to the slightly higher mean temperatures that were observed in the rooms with that type of ventilation.

The following observations are offered in support of that statement:

1. The rooms included in the studies were not selected in pairs in order to eliminate as far as possible the variable effects of differences in the age, sex, and racial characteristics of the pupils exposed to the different conditions studied;

2. There were marked differences in the social and economic status of the families represented by the pupils in the several schools;

3. The determinations of respiratory illness among the pupils present were made by nine nurses during the first study and fourteen during the second;

4. Variations in the incidence of respiratory illness among pupils is not exclusively related to variations or differences in the air conditions created by different types of school ventilation. For that reason, among others, respiratory illness is not a satisfactory criterion.

Certain essential data relating to the sex distribution of the pupils in the various classrooms of the second study were lost between the time of their collection and the date of publication of the report, and this discussion must, therefore, be limited to the first study, but, by reason of the fact that the fan-ventilated rooms as a whole had a far higher percentage of girls than did the window-ventilated rooms during both studies, and the ratios in the two years are fairly constant, as shown in Table 1, it appears not inappropriate to discount the implications based on both studies, on the findings from the first alone.

Comparisons must be restricted to classrooms in the same school in order to eliminate to the greatest possible degree, the effects of the differences in the social and economic status of the pupils attending the different schools, described by Doctor Baker as follows:

"The general type of children under observation included those of Russian, Italian, Irish and American descent, and of a social status that ranged from the well-to-do who live in comfortable homes, in sanitary surroundings, to the extremely poor, shiftless and ignorant type, where the children receive no home supervision or hygienic care."

This precaution also has the effect of compensating in a measure the otherwise dominant variable in the rates of respiratory illness among the pupils present—a criterion for which no standards exist—the personal equation of the observers.

However, a test with six pairs of nurses conducted by the writer in Syracuse schools in the spring of 1928, showed the closest agreement between any two nurses, examining the same group of pupils to determine the prevalence of respiratory illness among them, was 1 in 3, the average for the entire group was 1 in 5; the lowest was 1 in 9. It is on this finding that the writer bases the opinion that at the present time, respiratory illness is not a satisfactory criterion for judging the effects of classroom air conditions on the health of school children, and that determinations of respiratory illness made by different persons are worthless for comparative purposes. Comparisons between the rates reported by different observers must, therefore, be avoided.

Only four of the eight schools included in the first ventilation study in New York City, 1916, had class-

TABLE 1. Sex Distribution of the Pupils Exposed to the Two Types of Ventilation

School Ventilation Study—New York, N. Y., 1916-1917

Type of Ventilation	Percent Girls	
	First Study	Second Study
1. Window-Gravity	37	31
2. Mechanical	60	54
Ratio girls in classrooms with mechanical ventilation to those in window gravity rooms—Percent	162	174

rooms representing both of the two types of ventilation being studied. The sex and the grades of the pupils occupying these classrooms are shown in Table 2, which was compiled from the data presented on pages 602 and 603 of the Commission's report.

This table reveals the fact that in the first study, there were but three instances in which pupils of the same grade and sex distribution were exposed to the different conditions in the same school: Fourth grade boys in P. S. 2, Bronx; fifth grade girls in P. S. 59, Manhattan; and fifth grade boys in P. S. 165, Manhattan. It also shows that there were but six other instances in which pupils of the same grade, but not of the same sex distribution were exposed to the different types of ventilation in the same school: Third and fifth grades in P. S. 2, Bronx; fourth grade in P. S. 22, Manhattan; fourth grade in P. S. 59, Manhattan, and two instances in the fourth grade of P. S. 165, Manhattan.

In two of these six instances (fourth grade, P. S. 165, Manhattan), window-ventilated rooms occupied by boys exclusively served as controls for fan-ventilated rooms occupied by mixed groups; in one (fifth grade, P. S. 2, Bronx), a window-ventilated room occupied by girls exclusively was used as a control for a fan-ventilated room occupied by boys exclusively; in the three other instances, window-ventilated rooms occupied by mixed groups were used as controls for mechanically-ventilated rooms occupied by boys or girls exclusively.

The summary shows that out of a total of twelve window-ventilated rooms, two, or 16.7%, were occupied by girls exclusively, while for the fan-ventilated rooms the figures are 16, 9 and 56.2%, respectively.

Of course, a study of eight weeks' experience in three pairs of rooms, to which this method of treating the data restricts comparisons, is by no means of sufficient length or breadth to serve as a basis for any general conclusions as to the relative healthfulness of different methods of school ventilation, but it was interesting to learn that in the two of the three instances where, by virtue of the fact that they were similarly occupied, comparison is possible between results in one room with each type of ventilation, the window-gravity room reported the lower rate of absenteeism due to respiratory illness in one school (P. S. 165, Manhattan), while the fan-ventilated room reported the lower rate in the other school (P. S. 2, Bronx). In the third instance (P. S. 59, Manhattan), where five fan-ventilated rooms served as controls for a single room with window-gravity ventilation, two of the rooms with mechanical ventilation reported lower rates of absenteeism due to respiratory illness than did the single window-ventilated room, and three higher. *From the standpoint of absenteeism reported due to respiratory illness, this is just as even a result as was possible with the set-up.*

In five of the six instances in which pupils of the same grade, but not of the same sex distribution, were exposed to the different conditions in the same school, *the room with the higher percentage of girls reported the higher rates of respiratory illness absenteeism, regardless of the type of ventilation.* In the sixth instance (P. S. 22, Manhattan), in which three mechanically-ventilated rooms occupied by girls exclusively, served as controls for a single window-ventilated room occupied by a mixed group, one of the three mechanically-ventilated rooms occupied by girls exclusively, reported a lower rate of respiratory illness absenteeism than did the window-ventilated control occupied by pupils only 23% of whom were girls.

The conclusions to be drawn are:

1. Girls of elementary school age suffer more frequently from absence-causing respiratory illness than do boys of the same age groups (this fact has since been reported by others).

2. The higher rates of respiratory illness attributed to central fan-ventilation as a result of these studies, were in all probability due to differences in the sex distribution of the pupils, in view of the fact that when the results were summarized without regard for the factors of age, sex, race and social status of the pupils, 56% of the mechanically-ventilated rooms were occupied by girls, whereas less than 17% of the window-ventilated rooms were so occupied.

3. The *type* of ventilation is probably not, of itself, a factor in the incidence of respiratory illness among school pupils.

4. The thesis that the slightly higher temperatures noted in the fan-ventilated rooms and advanced as the most probable cause of the higher respiratory illness in such rooms appears unwarranted in the light of this interpretation of the results (this finding has also been confirmed by later studies).

Need we go further?

Perhaps just far enough to say that all of the other studies, whose findings have been cited as confirming the conclusions of the former New York State Commission, involve other uncompensated variables which very materially affect the results. Only in the Commission's air-change studies in Syracuse and New York City, and in the study of window-gravity versus unit ventilation in New York City during the school year 1928-29, have certain of these variables been brought sufficiently under control. The findings of these studies have not yet been released for publication by the Commission.

Future workers with a more appropriate and accurate measuring device may show the air conditions created by one type of ventilation to be more conducive to the health of the pupils than another but, for the moment, there is no reliable evidence upon which to base such a conclusion.

This declaration must not be interpreted as a license to install any hodge-podge system of mechanical ventilation, nor must it be construed as sanctioning the removal of all regulation of classroom air conditions. It does mean, however, that comfort is as good a criterion as any at present for judging the effect of ordinary air conditions on health, and that engineers and architects are justified in recommending, and school boards justified in installing in schools under their control, the most highly-perfected system of ventilation that will be intelligently operated, if they believe the advantages of such a system to be truly economical of time and money.

TABLE 2. GRADE (AGE) AND SEX DISTRIBUTION OF PUPILS

In Rooms of Schools Having Some Rooms with Mechanical- and Some With Window-Gravity Ventilation. First School Ventilation Study—New York City, 1916

By Type of Ventilation

Public School	Sex Distribution of Pupils	Grade and Type of Ventilation* 2 B	2 C	3 B	3 C	4 B	4 C	5 B	5 C	Total B	Total C
2 Bronx	Boys	—	—	—	1	1	1	—	1	1	3
	Girls	—	—	—	—	—	—	1	—	1	—
	Mixed	—	—	1	—	—	—	—	—	1	—
22 Man.	Boys	—	—	—	—	—	—	1	—	1	—
	Girls	—	—	—	—	—	3	—	—	—	3
	Mixed	—	—	—	—	1	—	1	—	2	—
59 Man.	Boys	—	—	—	—	—	—	—	—	—	—
	Girls	—	—	—	—	—	1	1	5	1	6
	Mixed	1	—	—	—	1	—	—	—	2	—
165 Man.	Boys	—	—	—	—	2	—	1	1	3	1
	Girls	—	—	—	—	—	—	—	—	—	—
	Mixed	—	—	—	1	—	2	—	—	—	3
Summary: All 4 Schools	Boys	—	—	—	1	3	1	2	2	5	4
	Girls	—	—	—	—	—	4	2	5	2	9
	Mixed	1	—	1	1	2	2	1	—	5	3
Total		1	—	1	2	5	7	5	7	12	16

* B—Moderate Temperature, open window.
C—Moderate Temperature, fan-ventilated, closed window.

Capacity Characteristics of Unit Heaters

by **CHARLES A. CARPENTER**

UNIT heaters have been available to industry on a production basis for several years and yet many erroneous impressions of the action of this equipment still prevail.

In order that a clearer picture of unit heater performance may be obtained, the author will discuss heater characteristic curves and correction factors from several angles. It is believed that a more careful analysis of the effects of varying inlet temperature, varying outlet temperature, design of radiation surface, fan applications and the relative position of the fan to the heating surface, is necessary in order to visualize any specific problem.

From the standpoint of general arrangement, several types of heaters are offered to the public that may be enumerated as follows:

(1) Horizontal Units—
(a) Fan blowing, (b) Fan drawing through heating surface.
(2) Vertical Units—Top Discharge —Bottom Inlet
(a) Fan blowing, (b) Fan drawing through heating surface.
(3) Vertical Units—Bottom Discharge—Top Inlet
(a) Fan blowing, (b) Fan drawing through heating surface.

Each of these six arrangements may be built with multivane or propeller fans.

Twelve general classifications are indicated that have different characteristics. We shall discuss these briefly in relation to fan engineering.

It is quite generally accepted that a fan, taking in air at different temperatures and delivering this air through an unchanged airway, will produce pressures or suctions, as the case may be, inversely proportional to the absolute temperatures, without appreciable changes in efficiency or volume. This is a very important basic factor in unit heater operation.

Other factors influencing results obtained from such equipment may be outlined as follows:

Consider an airway of fixed dimensions into which a fan at constant R.P.M. blows. The fan pressure for a constant temperature of 70° F. and barometer of 29.92 in. Hg. when handling dry air may be expressed thus

$$P = \frac{kV^2}{4005^2}$$

That is, fan pressure in inches of water is a constant times velocity-head, the constant, of course, depending upon the construction, design and size of the airway.

If the temperature of the air delivered by the fan be changed to t_e°, dry air at 29.92 in. Hg. being considered, the fan pressure becomes

$$P_e = \frac{kV^2}{4005^2}\,\frac{(460+70)}{(460+t_e)} = P\,\frac{(460+70)}{(460+t_e)}$$

The C.F.M., air velocity and fan efficiency remain practically constant for such variations in temperature, the horsepower varies as

$$\frac{(460+70)}{(460+t_e)}$$

when compared with the 70° H.P. The weight of air handled compared to the 70° weight varies as

$$\frac{(460+70)}{(460+t_e)}$$

Next, consider that a constant weight of dry air at 29.92 in. Hg. is blown through the airway. At 70° we get a volume "C" and a pressure "P."

At t_e° we get a volume

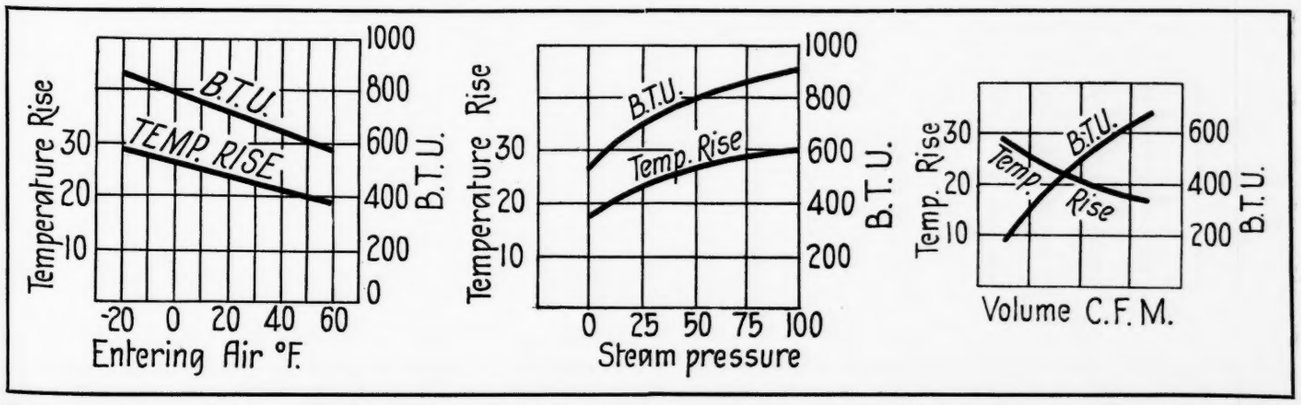
$$C\,\frac{(460+t_e)}{(460+70)}$$

an equivalent pressure

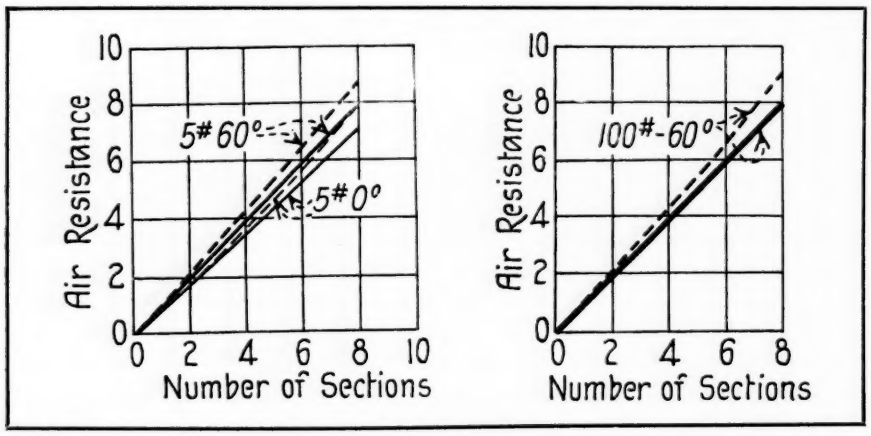
$$P\,\frac{(460+t_e)}{(460+70)}$$

an efficiency different from that at 70° and a horsepower dependent upon the fan characteristic.

Now let us draw air through the airway at 70°. We get pressure "P" and volume "C."



Diagrams Nos. 1, 2 and 3. Relations Between Inlet Temperature, Steam Pressures and Air Volume, and Temperature Rise



Diagrams Nos. 4 and 4a. Effect on Air Resistance of Increasing the Number of Heating Sections

If we exhaust the same volume C at $t°_f$ the pressure becomes

$$P \frac{(460 + 70)}{(460 + t°_f)}$$

Let the weight of air exhausted be constant. At 70° the pressure "P" and volume "C" remain, but at $t°_f$ the volume becomes

$$C \frac{(460 + t°_f)}{(460 + 70)}$$

and the pressure

$$P \frac{(460 + t°_f)}{(460 + 70)}$$

The relation of these four conditions to heaters generally is overlooked and consequently most heating apparatus is rated erroneously, except for conditions that have been met in actual tests. The temperature change from inlet to final temperature and the resultant change in air volume or air weight, as the case may be, must be taken into account, along with the characteristics of the fans being used.

A fan blowing horizontally through a radiating surface will deliver a volume of air at inlet temperature to the inlet side of the radiator. The actual weight of air delivered will vary, more or less, inversely as the absolute temperature at inlet. As this air is warmed by the radiator it expands proportionally to the ratio of its warmer temperature (absolute) to the inlet temperature (absolute).

The increase in volume of air blowing through a heater is measured by the absolute final temperature, divided by the absolute inlet temperature. Thus, if we have an inlet temperature of 70° F. (530° absolute) and a final temperature of 123° (583° absolute) the volume of air leaving such a heater would be

$$\frac{583}{530} = 1.1 \text{ times the volume handled}$$

by the fan. This change in temperature takes place progressively through the heating surface accompanied by a change in volume.

The general effect on the performance of the fan may be approximated algebraically—

let C = C.F.M. delivered by fan.

T_e = entering air temperature, absolute.

T_m = temperature of air averaged algebraically in passage through radiator.

A = free area through heater.

$V = \frac{C}{A}$ = average velocity for C.F.M. at temperature T_e.

$V_m = \frac{C}{A}\frac{T_m}{T_e} = V\frac{T_m}{T_e}$ = algebraic average velocity through heater.

P = Fan pressure when temperature is 70° F. $= \frac{kV^2}{4005^2}$

(no change in temp. thru system)

k = System resistance constant.

$P_m = \frac{kV^2}{4005^2}\frac{T_m^2}{T_e^2} \times \frac{T_e}{T_m} = \frac{kV^2}{4005^2}\frac{T_m}{T_e}$ = true fan pressure.

We can conclude that mean tem-

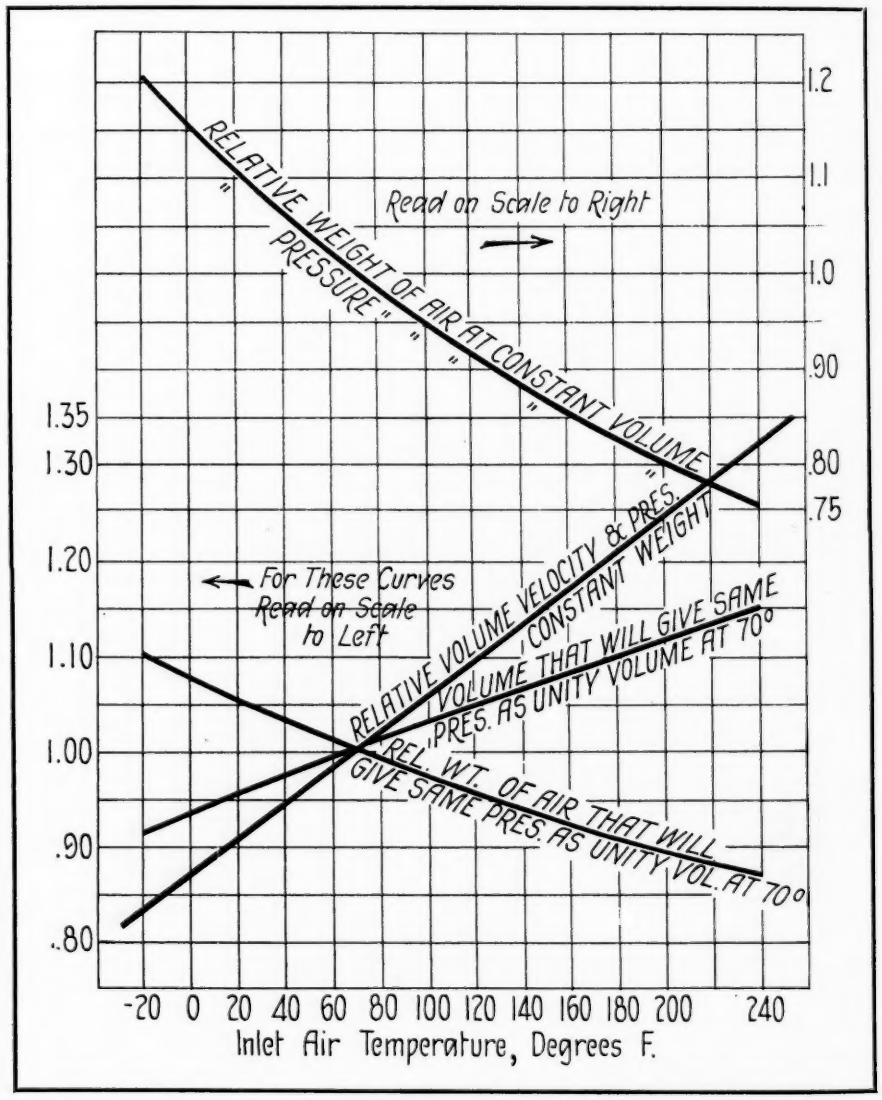


Diagram No. 5. Various Relations Applying to Air Passing Through a Fixed Airway

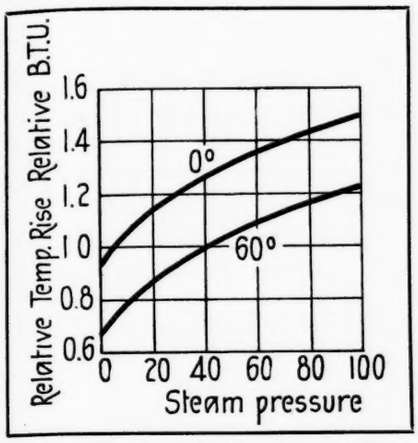


Diagram No. 6. Relation Between Steam Pressure and Relative Temperature Rise and Relative B. T. U.

perature (algebraically determined) affects the relative performance of a fan on a horizontal blow-through heater if the inlet temperature be constant. Thus, if we assume that a heater test gives a final temperature T_f and that T_m is a function of T_f, if higher steam pressures be used, T_f rises, the heater resistance rises and less weight of air is delivered by the fan, inlet temperature remaining constant.

It is apparent that the weight of air delivered by a fan serving a horizontal blow-through heater is influenced by entering temperature, the ratio T_m/T_e and the characteristics of the fan being used.

For the general practical heater arrangement, it may be stated that the change in capacity will be much greater with propeller fans than with multivane fans, due to the fact that propeller fans have much flatter characteristic curves than multivane fans for the zone of operation met in unit heater practice.

A few diagrams and tables illustrated herewith may make the above information clearer.

Diagram No. 1 shows the relation between inlet temperature and temperature rise for a typical heating surface when a constant weight of dry air at 29.92 in. Hg. is blown through the surface. The relative B.T.U. capacity is also shown.

Diagram No. 2 shows the relation between steam pressures (gauge) as abscissae and temperature rise (ordinates) for a heating surface when a constant weight of dry air at 29.92 in. Hg. is blown through the surface. The relative B.T.U. capacity is given for comparison with Diagram No. 1.

Diagram No. 3 shows the relation between C.F.M. of dry air at 70° F. and 29.92 in. Hg., and temperature rise for a blow-through heater. The corresponding B.T.U. capacity curve is given.

Diagram No. 4 shows the effect of increasing the number of heating sections on air resistance. The number of heating sections is used as a base scale. The ordinates represent relative air resistance for a constant velocity of dry air at 29.92 in. Hg. blown into the first section. The solid lines show the uniform increase in air resistance for various steam pressures and entering air temperatures generally assumed to apply in heating and ventilating work. The broken lines show the general trend of air resistance, taking into account the expansion from section to section. The variations between broken and solid lines for the same steam and air conditions show the general extent of the error in air resistance resulting from ordinary loose methods of figuring such jobs.

Table No. 1, computed from data applying to carefully-tested radiation, gives the basis for Diagram No. 4.

No attempt has been made to correct air resistance through one section of radiation, due to varying degrees of expansion of the air passing through such a section, since this correction must be based on accurate laboratory test. It is merely desirable to show that expansion of air passing through a heater changes the air resistance.

Diagram No. 5 shows various relations applying to air at different temperatures passing through a fixed airway as follows:

Constant weight of dry air at 29.92 in. Hg.

(1) Relative volume $C_t = C_{70}\ T/530$
(2) Relative velocity $V_t = V_{70}\ T/530$
(3) Relative pressure $P_t = P_{70}\ T/530$
(4) Volume that will give the same pressure as same unit of volume will give at 70° F.

$$C_t = C_{70}\sqrt{T/530}$$

(5) Relative weight of air that will give the same pressure as same

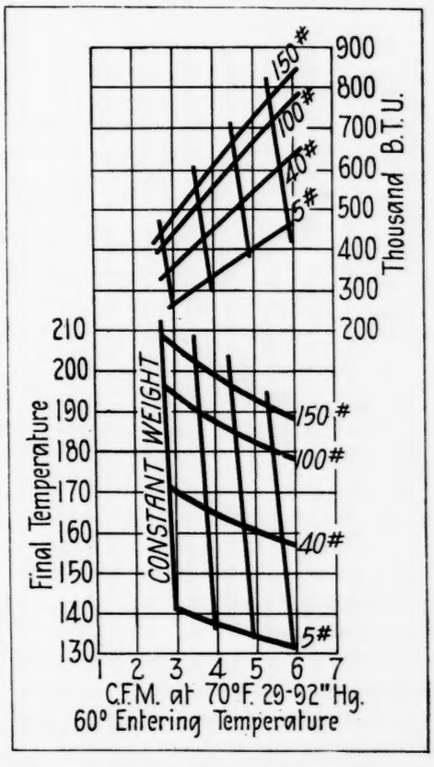


Diagram No. 7. Typical Draw-Through Unit Heater Curves for Various Steam Pressures

TABLE 1

No. of Sections	5 Lbs. Steam—60° Entering Air.		5 Lbs. Steam—0° Entering Air		Relative Air Resistance Corrected for Lower Entering Temp.	100 Lbs. Steam—60° Entering Air	
	C.F.M. at End of Section	Relative Air Resistance	C.F.M. at End of Section	Relative Air Resistance		C.F.M. at End of Section	Relative Air Resistance
1	1.018	1.000	0.919	1.000	0.885	1.039	1.000
2	1.049	1.030	0.961	1.045	0.925	1.089	1.048
3	1.078	1.058	0.999	1.089	0.964	1.132	1.090
4	1.100	1.080	1.033	1.125	0.996	1.172	1.129
5	1.120	1.100	1.062	1.157	1.024	1.208	1.162
6	1.142	1.120	1.090	1.188	1.050	1.239	1.192
7	1.159	1.138	1.111	1.210	1.071	1.266	1.218
8	1.174	1.153	1.132	1.233	1.091	1.291	1.242
Total		8.679		9.047	8.006		9.081

TABLE 2

Temp. Deg. F.	Constant Weight: Relative Volume Relative Velocity Relative Pressure	Constant Weight: Volume for Same Pressure at 70°	Constant Volume: Relative Weight Same Pressure as 70°	Constant Volume: Relative Weight Relative Pressure
−20	0.8302	0.9112	1.0975	1.204
−10	0.8510	0.9225	1.085	1.178
0	0.868	0.9317	1.073	1.152
10	0.8868	0.9416	1.062	1.128
20	0.9056	0.9516	1.051	1.104
30	0.9245	0.9615	1.040	1.082
40	0.9434	0.9713	1.030	1.060
50	0.9622	0.9809	1.020	1.039
60	0.9810	0.9905	1.010	1.019
70	1.000	1.000	1.000	1.000
80	1.019	1.010	0.9907	0.9815
100	1.057	1.028	0.9729	0.9465
120	1.094	1.046	0.9559	0.9140
140	1.132	1.064	0.9399	0.8832
160	1.170	1.082	0.9246	0.8548
180	1.208	1.099	0.9101	0.8282
200	1.245	1.116	0.8962	0.8032
220	1.283	1.133	0.8828	0.7795
240	1.321	1.149	0.8702	0.7572
	(1) (2) (3)	(4)	(5)	(6) (7)

unit of weight of air gives at 70° F. $W_t = W_{70} \sqrt{530/T}$

Constant Volume of dry air at 29.92 in. Hg.

(6) Relative weight $W_t = W_{70}\ 530/T$

(7) Relative pressure $P_t = P_{70}\ 530/T$

Table No. 2 shows the basis for plotting Diagram No. 5.

At constant R.P.M., constant volume and constant efficiency (approximately), a fan pressure varies as 530/T when referred to standard 70° rating. T = absolute temperature of dry air at 29.92 in. being handled.

A constant-speed fan, therefore, cannot deliver a constant weight of air at variable temperature through an unchanging airway. Similar reservations must be made for changing barometer, relative humidity or other factors affecting the density of the gases being handled.

It has been quite general to make corrections for the capacity of steam heating equipment by correction factors purporting to apply to various entering air temperatures and steam pressures (gauge).

Since the formula $\frac{t_s - t_e}{t_s - t_f} = \text{constant}$, generally in use for computing these factors, is based on constant weight of dry air at 29.92 in. Hg. passing through a given heater, it is apparent that such correction factors do not apply to commercial unit heaters or similar devices.

In the formula

t_s = temperature of steam, deg. F.
t_e = entering air temperature, deg. F.
t_f = final air temperature, deg. F.

We shall first show that the use of these erroneous factors introduces discrepancies in unit heater ratings well worth considering.

Diagram No. 6 shows the relation between steam pressure and factors derived from the above formula for 0° and 60° F. entering air. If we assume that a horizontal blow-through heater actually has been tested with 5 lbs. steam and 60° dry air at 29.92 in. Hg., we can visualize how such a heater capacity will deviate from the capacity derived by using these factors.

Analyzing the 60° performance first, we know that the fan must operate in accordance with its constant R.P.M. characteristic at 60°. For steam pressures above 5 lbs. the air passing through the heater will ex-

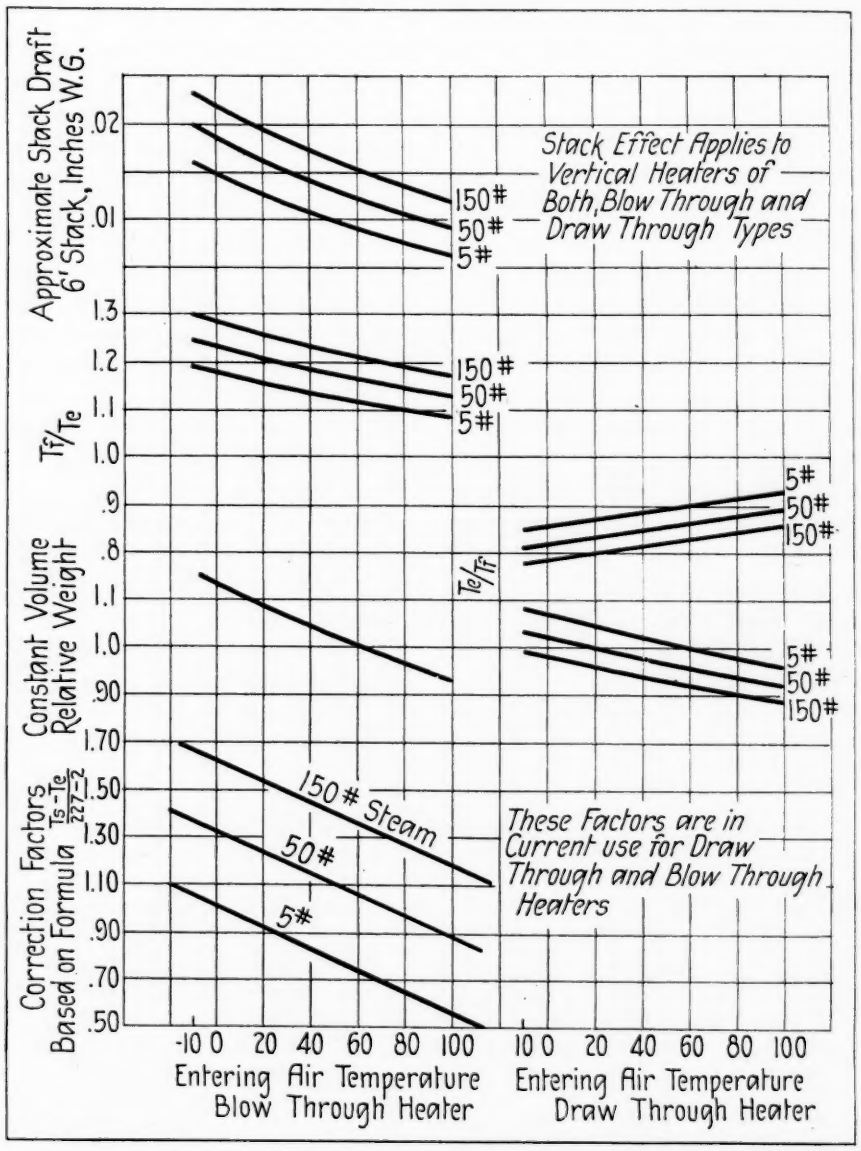


Diagram No. 8. Features to Be Considered to Obtain True Ratings of Unit Heaters

pand more than at 5 lbs. Consequently, the fan resistance increases and the heater capacity will be less than shown by the factors. For steam pressures under 5 lbs., the fan will handle slightly more air, giving more capacity than indicated by the factors.

The 0° condition is more complicated. The fan tends to deliver an increase in weight compared to 60° conditions following the ratio $\frac{520}{460} = 1.13$. This of itself would give lower final temperatures and more B.T.U. than indicated by the factors. However, these discrepancies are offset more or less by the increase in relative fan resistance, due to the greater expansion of air from 0° entering compared to 60° entering temperature. It seems apparent, however, for steam pressures ordinarily encountered, that the heater capacity with 0° entering air would be more than shown by the factors.

Induced Draft Heaters

The horizontal draw-through or induced draft heater will next be considered. We have shown that a constant-speed fan taking air at varying temperatures tends to deliver a constant volume, provided no change takes place in temperature while the air flows through a fixed airway. It has been customary to assume that draw-through heaters deliver constant C.F.M. at constant R.P.M., regardless of steam pressure or entering air temperature.

Again, starting with the 60° entering air and 5 lbs. steam pressure test we find that the weight of air passing through such a heater falls off quite rapidly as steam pressure is increased and final temperature rises. At the same time, relative resistance decreases, due to the increasing expansion and decreased weight of the air, so the fan tends to deliver more C.F.M.

There can be no doubt that the usual correction factors give inflated capacity ratings for horizontal draw-through heaters taking 60° entering air and when adjusted for high steam pressures from 5 lb. tests.

With air entering at zero degrees, ratings for low-pressure steam corrected from 5 lb.—60° tests by usual factors, probably are low, but for very high-pressure steam the correction factors may give inflated values.

Vertical blow- and draw-through heaters with top discharge, due to stack effect, tend to reduce the pressure or suction of the fans. This, of course, tends to increase capacity.

Such heaters, inverted so as to have top inlet and bottom discharge, have adverse stack effects, tending to reduce capacity.

Diagram No. 7 shows some typical draw-through unit heater curves for various steam pressures. The base scale represents C.F.M. measured at 70° F.—dry air at 29.92 in. Hg. Final temperatures and B.T.U. capacities are shown as ordinates. If the 5 lb. steam-pressure curve represents test results, points vertically above represents capacities and temperatures obtained by using currently-accepted correction factors. The straight lines inclined backward from the vertical represent constant volume of air and indicate that the correction factors give final temperatures that are low and B.T.U. capacities that are high.

Diagram No. 8 summarizes the features that must be considered in order to obtain true ratings of unit heaters. The correction factors generally in use are supposed to apply to all types of unit heaters but actually are based on constant weight of dry air. The relative weight at constant volume of air for blow-through and draw-through heaters shows that the factors are inaccurate.

The ratio T_f/T_e for blow-through heaters and T_e/T_f for draw-through heaters is some measure of the changing relative air resistance through the heater. Accurate tests would reveal the change in air weight blown or drawn through the coils, due to expansion of the air.

The theoretical stack effect for a 6-ft. stack shows how this item may influence heater performance.

Diagram No. 8 is based on a heater giving 120° final temperature with 5 lb. steam and 60° entering air temperature.

In conclusion, it must be apparent that an expert knowledge of fan engineering is a necessary basis for unit heater design and application. It is also evident that the air resistance through the radiator, the fan characteristics, and the stack effect are dependent upon heater design.

Handbook of Building Construction

For the heating and ventilating engineer, the "Handbook of Building Construction," by Hool and Johnson contains the information which the engineer often needs of operations which do not come directly under the headings of heating and ventilating, such as foundations, steel work, sheet metal work, engines and construction methods. For this reason although the books contain fairly complete information on heating and ventilating, they will be valuable in the engineer's library for their information on general building data.

Skylights and ventilators are treated in a 6-page section by John S. Branne, and chimneys in an 8-page section by the late W. Stuart Tait.

Heating, ventilation and power are treated in a 95-page section by Ira N. Evans. In this new edition, while heat losses are covered in a general way, no data have been presented on heat losses through insulated walls.

On the whole, however, the material is well edited and well arranged and will fill a valuable place in the engineer's bookcase.

Published by McGraw-Hill Book Company in 2 vols. Size 6 in. x 9⅜ in. Pages 1611. Price $10, or may be secured from our Book Department, HEATING AND VENTILATING, 521 Fifth Ave., New York.

Men and Machines

Engineers and men who live by and with machines will be interested in Stuart Chase's new book "Men and Machines."

Certain philosophers maintain that machinery is enslaving us. In this book Mr. Chase sets out to discover, via numerous statistics, the extent of our serfdom. He tells something of the anatomy of machines; something of their development from James Watt to the mechanical man; the amount of contact that the average man has with machines day in and day out, and their effect on the worker's mind.

Mr. Chase then balances the manifestly good and bad effects of the machines and draws the conclusion that it is futile to voice judgments for or against the machine. He has made an honest attempt to discover what may happen in an increasingly mechanized world when only known facts are considered.

Many interesting illustrations are included in this book, which is published by The Macmillan Company. Size 5 in. x 7 in. Pp. 354. Price $2.50, or may be secured from our Book Department, HEATING AND VENTILATING, 521 Fifth Ave., New York.

Operating Data on Domestic Stokers Burning Anthracite

by **NOEL CUNNINGHAM**

MUCH that has been published regarding efficiencies of household heaters using anthracite is misleading due to the fact that data are based upon hand firing and that more modern methods of using anthracite are ignored. Automatic burners for anthracite have been in use throughout the anthracite consuming territory for many years. They are operating satisfactorily and, in the ordinary cast-iron heaters, are producing efficiencies comparable with those obtainable with other fuels even where the latter are burned in heaters especially adapted.

Shown herewith are the results of an investigation to determine actual performance of domestic heaters using anthracite and the modern anthracite burner. The tests were made by the writer during the present heating season and represent actual running conditions as found. Information as to the location of the plants tested will be supplied upon request and all are available for checking by any one sufficiently interested.

Selection of the plants for tests was made at random over an area comprising parts of Connecticut, New York, New Jersey and Pennsylvania. There is represented a diversity of heaters, heating systems and capacities.

The formula used for determination of stack loss is

$$S.L. = 0.4\left(\frac{T-t}{CO_2}\right)$$

where:

S.L. = Per cent of the heat value of the fuel fed lost up the stack.

t = Temperature of the air inlet to the stoker fan, deg. F.

T = Temperature of the stack gases, deg. F.

CO_2 = Per cent CO_2 (volumetric) in stack gases.

In deriving the formula the assumption is made that there is no CO in stack gases, since this is true when the automatic anthracite burner is used; the presence of water is disregarded, which introduces an inconsiderable error, and heat value of anthracite "ash and moisture free" (the pure carbonaceous portion) is 14,800 B.T.U. per lb. which has been found a close average. The formula is derived as follows:

$$S.L. = \frac{100 \times \text{dry heat in flue gases}}{\text{Heat content of fuel}}$$

$$S.L. = \frac{100 \times W \times (T-t) \times S}{\text{Heat content of fuel fed}}$$

where W = weight of flue gases and S = specific heat of flue gas.

For perfect combustion, burning 1 lb. of the pure carbonaceous element of anthracite, 44/12 = 3.667 lbs. of CO_2 is produced according to the chemical reaction,

$C + O_2 = CO_2 = 12 + 32 = 44$

When burning 1 lb. pure carbonaceous element, the weight of flue gas equals

$$\frac{100 \times 3.667}{\%\ CO_2 \text{ by weight}}$$

The % CO_2 by volume = 1.473 × % CO_2 by weight. [Note—Factor 1.473 is the average of CO_2 by volume divided by CO_2 by weight for 6% CO_2 (volume), 8% CO_2 (volume) and 10% CO_2 (volume)], hence the weight of gas in pounds when burning 1 lb. pure carbon is

$$\frac{100 \times 3.667}{1.473 \times CO_2}$$

Specific heat of stack gases is usually taken 0.24 B.T.U. per lb. so that

$$S.L. = \frac{100\dfrac{100 \times 3.667}{1.473 \times CO_2}(T-t) \times 0.24}{14{,}800}$$

STACK LOSSES FROM STOKER-FIRED DOMESTIC HEATERS

FURNACES

No.	Date	Location	Furnace	Load	Burner	Descrip'n Coal	Rate of Feed, Lb./Hr.	Intake Temp.	Stack Temp.	CO_2	Stack Loss
F1	12-24-29	Hazleton, Pa.	Beechwood 48-24	140 Sq. In. Outlet	HR	Jeddo Rice	8	60°	800°	7.0%	43.0%
F2	1-1-30	Hudson, N. Y.	Comfort 640	300 Sq. In. Outlet	H2R	Jeddo Bkwt.	8	72°	545°	6.0%	32.1%
F3	1-4-30	Bethlehem, Pa.	Holland 45	400 Sq. In. Outlet	H2R Intermed.	Greenw'd Rice	13	65°	820°	7.6%	45.7%
F4	1-10-30	Norwalk, Conn.	Kelsey No. 27, Series C	710 Sq. In. Outlet	H2R	Yard Screened Bkwt.	11	65°	245°	6.3%	12.0%
F5	1-10-30	New Canaan, Conn.	Holland 60B	850 Sq. In. Outlet	H2R	Yard Screened Bkwt.	17	65°	545°	6.1%	31.8%
F6	1-10-30	New Canaan, Conn.	Andes 1100A	590 Sq. In. Outlet Forced Circ.	M	Jeddo Bkwt.	13	75°	470°	6.2%	26.7%
F7	1-10-30	Greenwich, Conn.	Richardson & Boynton "Perfect" 4904L	590 Sq. In. Outlet	H2R	L.C. & N. Bkwt.	11 17	72° 72°	410° 547°	9.0% 9.8%	15.2% 19.6%

STACK LOSSES FROM STOKER-FIRED DOMESTIC HEATERS

BOILERS

No.	Date	Location	Boiler	Load	Burner	Descrip'n Coal	Rate of Feed, Lb./Hr.	Intake Temp.	Stack Temp.	CO_2	Stack Loss
1	12-6-29	Saugatuck, Conn.	A. R. Co. Water Tube 2909	1780 Vapor	K sp.	Bkwt.	42	80°	425°	8.0%	17.6%
2	12-7-29	Westport, Conn.	A. R. Co. Red Flash 2-6-7	800 Steam	H2R-M 60/1	Bkwt.	30	80°	525°	8.3%	18.1%
3	12-7-29 12-9-29 12-27-29	Stamford, Conn.	Burnham W285	800 H.W.	H2R-M 60/1	Yard Screened Rice Bkwt. Bkwt.	30 33 15	55° 55° 55°	578° 580° 527°	8.4% 8.3% 7.6%	25.3% 25.3% 25.3%
4	12-8-29	Norwalk, Conn.	Burnham 2306	275 Vapor	HR Intermed. 105/1	Greenw'd Rice	7	60°	303°	11.0%	9.0%
5	12-9-29	Norwalk, Conn.	A. R. Co. S-22-7	738 Steam	H2R-M 17" Ring	Bkwt.	15	72°	383°	5.2%	24.3%
6	12-13-29	N. Bergen, N. J.	Ideal 468	2800 Steam	K and K sp.	Bkwt.	84 10	84° 84°	650° 450°	7.0% 8.9%	32.9% 16.7%
7	12-13-29	N. Bergen, N. J.	A. R. Co. S-22-6	500 Vapor	H2R	Bkwt.	13	70°	430°	7.0%	20.9%
8	12-14-29	Stamford, Conn.	H-B 324	439 Steam	H2R	Yard Screened Rice	22	70°	587°	8.0%	27.5%
9	12-14-29	Darien, Conn.	A. R. Co. Red Flash 2-S-7	1000 Steam	K	Bkwt.	20	70°	495°	6.0%	28.8%
10	12-16-29	Montclair, N. J.	Thatcher 26-02	608 Steam	H2R	Rice	17	70°	715°	7.4%	35.5%
11	12-16-29	Somerville, N. J.	A. R. Co. S-28-7	1400 H.W.	HR	D & E Rice	21	70°	400°	13.0%	10.3%
12	12-17-29	Verona, N. J.	Thatcher Progress 628	1276 Steam	K	Bkwt.	40	75°	505°	8.0%	21.9%
13	12-17-29	Glen Ridge, N. J.	A. R. Co. 3-25-S	800 Steam	M	Bkwt.	30	70°	595°	11.6%	18.4%
14	12-18-29	Westfield, N. J.	Thatcher 23-03	950 Steam	M	Bkwt.	36	70°	695°	11.4%	22.3%
15	12-18-29	Westfield, N. J.	Thatcher 19-03	450 Steam	H2R Intermed.	D & E Rice	13	80°	560°	11.6%	16.9%
16	12-19-29	Summit, N. J.	Mills 38-8	2000 Steam	K sp.	D & E Rice	36	75°	300°	6.0%	15.0%
17	12-20-29	Fair Haven, N. J.	A. R. Co. Red Flash 1-S-9	740 Vapor	H2R	Hazlebr'k Rice	23	75°	425°	8.0%	15.5%
18	12-24-29	Hazleton, Pa.	Dom. Stoker Co. WR-0	80 Gal. H.W. Stg.	WR	Jeddo Rice	5	60°	580°	8.6%	24.6%
19	12-27-29	Darien, Conn.	International 22 in. Grate, 6 Sect'n	1050 Vapor	H2R	Loc. Gap. Bkwt.	23	65°	445°	7.1%	21.7%
20	12-28-29	Red Bank, N. J.	A. R. Co. Red Flash 1-10-W	800 H.W.	H2R	Hazlebr'k Bkwt.	21	70°	380°	9.0%	14.0%
21	12-30-29	Bronx, N. Y. C.	Empire Intermediate 22 in. Grate	900 H.W.	H2R	Bkwt.	21	70°	605°	6.0%	36.3%
22	12-31-29	Beacon, N. Y.	Weil-McLain 5-W-22	500 H.W.	H2R Intermed.	L.C. & N. Bkwt.	13	70°	495°	9.6%	18.0%
23	12-31-29	Hudson, N. Y.	Mills Brick Set 4½	2400 Steam	M and K	Pa. C. Co. "Pittston" Bkwt.	35	70°	275°	7.6%	11.0%
24	1-1-30	Hudson, N. Y.	H-B 327	850 H.W.	H2R	Jeddo Bkwt.	17	72°	475°	12.6%	13.0%
25	1-1-30	Albany, N. Y.	A. R. Co. 4-22	348 H.W.	H2R Intermed.	D.L. & W. Rice	11	72°	545°	6.0%	32.1%
26	1-3-30	Caldwell, N. J.	Richardson 325-S	1076 Steam	K	Pa. C. Co. Rice	30	72°	575°	7.6%	26.9%
27	1-4-30	Bethlehem, Pa.	A. R. Co. W-25-C	1400 H.W.	M	Greenw'd Rice	21	75°	500°	7.6%	22.7%
28	1-4-30	Bethlehem, Pa.	Unnamed "Size No. W221"	400 H.W.	H2R Intermed.	Loc. Mtn. Rice	13	65°	570°	10.1%	20.3%
29	1-5-30	Bethlehem, Pa.	Weil-McLain 6-W-25	870 H.W.	H2R 60/1	Greenw'd Rice	18	70°	535°	8.4%	22.5%
30	1-7-30	Yonkers, N. Y.	Bryan Model F, Size 10	1728 H.W.	H2R	Bkwt.	17	82°	270°	7.0%	10.9%
31	1-7-30	Tarrytown, N. Y.	A. R. Co. Red Flash 1-W-8	922 H.W.	H2R	D & E Bkwt.	22	72°	470°	8.0%	20.2%
32	1-10-30	New Canaan, Conn.	International Triple Service No. 25	3300 H.W.	2M's	Jeddo Bkwt.	22	75°	310°	10.2%	9.3%

$$S.L. = 0.4 \frac{(T-t)}{CO_2}$$

To compare absolutely the efficiencies with which fuel is utilized in household heaters would require the determination of "nozzle efficiencies" of the heaters. This, of course, is normally practicable only in the laboratory and, even under laboratory conditions, uncertainties are prevalent.

The efficiency of any heater is the ratio of the heat output to the heat input. With the anthracite burner the heat input is the heat value of all the fuel fed during a given period. Losses comprise, in addition to the stack loss, the heat value of the carbon in the ashes and radiation from the heater surface. The burner fuel is buckwheat or rice size anthracite and the quality of the ashes can be judged from appearance. Hundreds of tests made in the field and tests during eight years of laboratory operation have established a standard ash appearance as the indicator for proper air adjustment. From 3% to 7% of the heat value of the fuel is lost in unburned carbon in ashes; for the purpose of this discussion 5% may be taken as average.

Radiation loss from heater surfaces is variable and, within limits, controllable. Most householders maintain a comfortable temperature in the cellar and radiation loss from heater surfaces varies from 3% to 10%; an average of 7% is a usual allowance.

Tabulation of the stack losses shows an average of 20.4% for the 32 tests on boilers. These can be further segregated as follows:

44% of boilers have stack losses under 20%.

25% of boilers have stack losses under 15%.

16% of boilers have stack losses under 12%.

Adding an average of 12% for ash-pit loss and loss by radiation from boiler surfaces, the average total loss for the 32 tests is 32.4% and:

44% have total losses under 32% = 68% efficiency.

25% have total losses under 27% = 73% efficiency.

16% have total losses under 24% = 76% efficiency.

Seven furnaces tested showed an average stack loss of 29.8%. The lowest was 12% and the highest 45.7%. These furnace tests are of particular interest as illustrating a prevailing tendency in warm-air installations, namely, failure to provide adequate area of outlet ducts. In a well proportioned warm-air gravity system 1 lb. of coal fed to the burner per hour will normally care for 50 sq. in. of outlet. Test F.4 indicates a stack loss of only 12%, but the rate of coal feed was 11 lbs. per hr. for 710 sq. in. of warm-air outlet or 80% of correct maximum feed. In test F.3, where a stack loss of 45.7% was found, the coal feed was 13 lbs. per hr. for 400 sq. in. of outlet or 160% of correct maximum feed.

Test F.7 was taken at two rates of feed. Correct maximum coal feed for this furnace is 12 lbs. per hr.; at 11 lbs. per hr. the stack loss was 15.2%, while at 17 lbs., 140% of correct maximum, stack loss was increased to 19.6%.

Two furnaces, tests F.5 and F.6, are provided with forced circulation, the fan not operating at the time the tests were made. Both have long leads through which no circulation is obtained under gravity conditions. Excessive stack losses resulted in both cases while with forced circulation comparatively low stack losses would be expected.

Tests on furnaces indicate that a proper warm-air system equals in efficiency a good steam or hot water system. However, improper design or operation can introduce greater losses in the former than in the latter.

Data presented provide ample indication that it is high time to discard performance figures which are commonly used as a basis of comparison with other fuels.

Appendix

Some who have commented on this tabulation have complained that the CO_2 is below that obtained in power plant practice. This suggests a question. Suppose a power plant were run by its purchasing agent and that about ten minutes during the day was all he devoted to the operating details. Assume that all the additional attention the power plant received was occasional adjustments of automatic controls and rate of fuel fed by the floor sweeper, and that mechanical details were more or less attended to by the yard man, a recent importation from Portugal. What would happen to the CO_2?

Another consideration—quality of ashes. Where will one find the householder who will be satisfied with ashes such as the highly efficient power plant turns out? It is no use telling him that a derby hat full of coal in ashes is saving a bathtub full of coal which would otherwise send its heat uselessly up the stack. He can see the coal in the ashes and will be happy only when it is eliminated—let the B.T.U.'s go where they will. The man who installs a coal burner and who knows his job will set the air to give a comfortable 8% rather than a hair-trigger 12%.

EDITOR'S NOTE—We have received a criticism of this article from an engineer who states that the CO_2 alone has been measured, and no determination of the CO has been made in these tests. He points out that in Test No. 15 the stack loss is 16.9%. If 10% of the coal had burned to CO, 1% of CO would have been present in the flue gases. This would have raised the stack loss to 21%.

However, from twelve tests made at The Frost Research Laboratory, no CO was obtained with the stoker in question when the CO_2 readings were below 11%.

At any rate, as the author points out, these installations are available for tests at any time by engineers who wish to determine for themselves the actual stack losses in stoker operation.

Engineers Gaining Recognition as Executives

A greater demand for engineer executives is seen by Nicholas S. Hill, Jr., of New York, president of the Hackensack Water Company. However, he deplores a tendency to push engineers into public posts simply because they are engineers.

Mr. Hill, a graduate of Stevens Institute, and a member of the American Society of Civil Engineers, raises the question whether the professional work of an engineer is not fully as important as executive responsibility.

"Unquestionably," says Mr. Hill, "one of the most gratifying changes which has taken place with respect to the engineering profession during the last century is the recognition of the fact that the engineer is not purely a technician, but that many engineers are endowed with broad common sense, judgment and executive ability.

"Whereas formerly men serving in public office on national and state commissions, or selected as the executives of large corporations were drawn almost exclusively from the field of business and the legal profession, it is very common to see engineers selected at this date.

Estimating and Designing Heating Systems

Part IV—Hot Water Empirical Rules and Formulas

by **FRED W. HANBURGER**

Special Lecturer on Heating and Ventilation, College of the City of New York

THERE have been so many kind expressions received that I find myself preparing this installment with a much stronger sense of intimacy between my readers and myself—a sort of "get-together" spirit and movement towards a better understanding of our subject. At the same time, it gives me a greater feeling of responsibility.

In the previous installments we undertook, and carried through, the design of hot water heating systems by the method of precise pipe friction balance. I would enjoy taking my readers through the entire course with the same celerity but we sometimes learn best by making haste slowly. To better understand our subject, it is well to take occasional trips in retrospect and compare other methods of design that are being used and which may differ from ours both in principle and result; to study them, analyze them and note what these differences may be.

The three principal other methods involve the use of equalization tables, equivalent areas or empirical pipe capacity tables.

To investigate these we must carry our general formula of flow a little further.

In Lesson 1, our formula for flow was expressed by the general equation

$$p = \frac{\pi \times D \times L \times fV^2}{A}.$$

As stated before this is but a general expression, and for more precise results, the value of f must be determined by trial for the various diameters of pipe and for varying velocities. For our present investigation it will be more convenient to have the volume or quantity shown in the formula, rather than the velocity. Substituting for V^2, its equivalent of $\frac{Q^2}{A^2}$, and expressing A as $\frac{\pi D^2}{4}$, the equation becomes $64\ Lf \frac{Q^2}{D^5}$.

Taking L as unity the term 64 Lf is a constant and the equation may be stated

$p = c \frac{Q^2}{D^5}$, where c is the constant. Transposing,

$$Q^2 = \frac{p}{c} D^5$$

and if we wish to have the same friction pressure loss at all times then $\frac{p}{c}$ may be taken as constant and we have

$$Q^2 = CD^5 \text{ or } Q = CD^{5/2}$$

where C is the combined constant.

This signifies that for the same friction pressure loss per unit of length, the quantity flowing in the different size pipes will vary as the square root of the 5th power of the diameter.

The value of $D^{5/2}$ for various diameters is calculated and tabulated in Table 3 below. The value for 1 is, of course, still unity. For a pipe of 2 in. diameter the tabulated value is 5.65 and is obtained from $\sqrt{2^5}$ or $\sqrt{32} = 5.65$.

A 2-in. diameter pipe, therefore, will deliver as much water as 5.65 1-in. pipes, for the same friction loss per unit of length.

While the values in Table 3 are exact, still the results from a formula which is but a general one for the theory of flow will not be precise owing to the changing value of the friction coefficient for varying diameters and velocities. The student should refer to the chart, Fig. 5 in Lesson 2 and make numerous comparisons.

TABLE 3
Equalization Table

Dia. of Pipe, In.	$D^{5/2}$	Dia. of Pipe, In.	$D^{5/2}$
½	0.18	3	15.59
¾	0.49	3½	22.92
1	1.00	4	32.00
1¼	1.75	5	55.90
1½	2.75	6	88.15
2	5.65	7	129.65
2½	9.88	8	180.00

As an example: Assuming a friction pressure loss of 0.02 lbs. per sq. ft. per lineal ft., the chart indicates a flow of 240 lbs. for a 1-in. pipe.

According to the equalization tables, a pipe 2 in. in diameter should deliver $5.65 \times 240 = 1356$ lbs. for this same friction loss. The chart indicates 1450 lbs. Similarly a ¾-in. pipe by the equalization method would carry $0.49 \times 240 = 118$ lbs. while the chart indicates about 125 lbs.

Values given in Table 3 are abstract numbers and represent nothing more than the comparative capacity values for the various sizes of pipe for the same friction loss per unit of length. They can be converted into radiation values as is shown later in this installment.

The student should calculate a number of them to become familiar with their use and origin. It is not necessary that he use them in his heating design—at least not exclusively—but a knowledge of their use will help him to reason and understand many of his future heating problems. He also will find them invaluable in water supply plumbing

TABLE 4

Approximate Capacity of Mains.
Temperature Drop 20° F.
Mains 100 ft. long.

Pipe Size In.	Capacity, Sq. ft. of Direct Radiation	Pipe Size In.	Capacity, Sq. ft. of Direct Radiation
1	35	3½	861
1¼	61	4	1120
1½	92	5	1956
2	198	6	3085
2½	346	7	4536
3	546	8	6300

layouts to which they readily lend themselves.

The method of design with the equalization tables is partially shown by Fig. 11. Beginning at the extreme end of a run or circuit the sizes of the radiator connections are determined upon either from practical knowledge or from empirical tables such as Table 5. Thus for radiators 1, 2 and 3 we have ¾ in., ¾ in., and ½ in. connections respectively. The sum of the equalization values of these connections gives the equalization value of the riser supplying them. This sum is

$$0.49 + 0.49 + 0.18 = 1.16,$$

so that a 1-in. pipe, although slightly small, can be used from the second to the third floor. As the 1-in. branch to radiator No. 4 is reached, its value is added to that already obtained and we have $1.16 + 1.00 = 2.16$, which suggests a 1½-in. riser down to the first floor. Here we encounter the two 1¼-in. branches, and adding their values to the accumulated sum we have

$$2.16 + 1.75 + 1.75 = 5.66,$$

which indicates a 2-in. main until the next riser is encountered. The value is again added at this point, giving

$$5.66 + 2.75 = 8.41$$

which approaches the value of a 2½-in. pipe and this size is therefore used. In this way the pipes are sized to the boiler.

Let us now consider the value of a design by this method. If the radiator connections were determined upon by the amount of radiation they supply, and regardless of their height above the boiler, we would then have a constant friction loss per unit of length throughout the entire installation.

This, however, is not good design, as we have seen that the upper radiators must be throttled more than those on the lower floors. In all cases of this kind the upper radiators will heat first and oftentimes prevent the lower radiators from becoming more than merely warm and sometimes keep them entirely cold. If the size of the radiator connections are determined upon from empirical tables, such as Table 5, which take their floor location or height from the boiler into consideration, a somewhat better balance is obtained because there is an increased throttling to the upper radiators. However, the distance of the radiators from the boiler is not considered and, therefore, on each floor, the radiators nearest the boiler will heat first at the expense of those more remotely located.

This discrepancy is partially overcome by some designers with the so-called reversed return, thus making each circuit of approximately the same length. Nevertheless, in no such case can we have assured precision. As an example, in Fig. 11 it will be seen that radiator 6 will heat before radiator 5 due to the longer branch to No. 5.

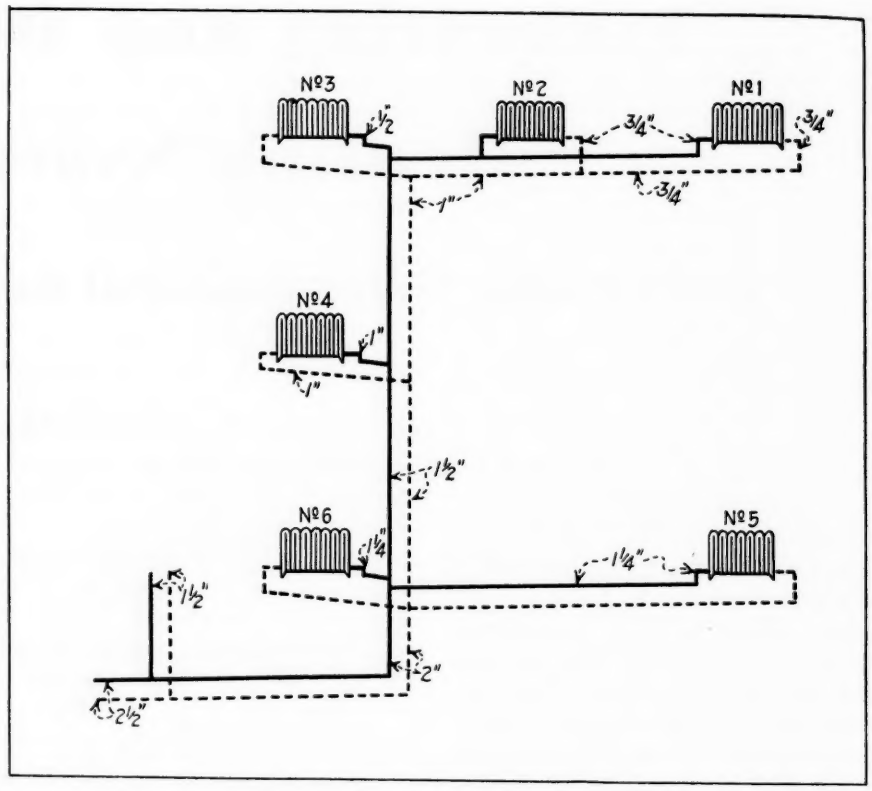


Fig. 11. Layout of Water System

TABLE 5

Approximate Capacity of Risers
Temperature Drop in Radiators, 20° F.
Two-Pipe Upfeed.

Pipe Sizes.	First Floor.	Second Floor.	Third Floor.	Fourth Floor.
½	6	10	12	13
¾	14	22	27	31
1	33	53	63	74
1¼	58	93	110	129
1½	90	146	173	203
2	186	298	353	419
2½	326	522	619	727
3	515	824	978	1148

EQUIVALENT AREAS. This method of design is similar to that of the equalization tables except that the respective areas of the pipes are used instead of their equalization values. A system of this kind will then have an equal velocity throughout instead of an equal friction loss. The same discrepancies, as pointed out above, are apt to become manifest in this case as in the former and possibly to a greater degree.

APPROXIMATE EMPIRICAL TABLES. Tables of this nature give an empirical amount of radiation by the various sized pipes, and when used with discretion and judgment will give fair results. We have already learned, however, that the same size pipe will not supply the same amount of radiation under all conditions. Each set of tables is therefore based upon some standard style of architecture and on some fixed drop in temperature between the supply and flow waters.

Due to this multiplicity of conditions tables published by various authors differ materially and the designer is often in doubt as to the one

to adopt. A good rule to follow is never to adopt any rule or table without first investigating and understanding its use and principles. Since there are so many existing tables it will not do any harm for us to add one or two more and make our own. For the purpose of illustration let us assume a 6-ft. height to the first floor radiators. With 7-ft. ceilings we have an approximate added height of 8 ft. for each additional floor. The tables are to be constructed for a temperature drop of 20° F. between the flow and return. These tables are given below with a description of their construction. It is earnestly suggested that the student will calculate others for different conditions, not so much that their use is advised, but for the knowledge he will gain by so doing.

Construction of charts of this nature is based on such principles as we have already discussed. With a 6-ft. generating head and a drop in temperature in the radiators of 20° F., the power generated by the first floor radiators is

6 ft. × 0.42 lbs. per sq. ft. = 2.52 lbs. pressure per sq. ft.

which is available for friction through 100 lin. ft. of main. (50 ft. of flow and 50 ft. return.) This gives a permissible loss of

$$\frac{\text{2.52 lbs. per sq. ft.}}{\text{100 ft.}} = \text{0.025 lbs. per sq. ft. per lin. ft. of pipe.}$$

Referring to the chart, Fig. 5, for this loss we find that a 1-in. pipe will carry 280 lbs. of water per hr. Taking the value of hot water radiation as 160 B.T.U. per sq. ft. per hr., and as each pound of water must give up 20 B.T.U. when its temperature drops 20° F., the amount of water needed for each square foot of radiation is

$$\frac{\text{160 B.T.U. per sq. ft. per hr.}}{\text{20°}} = \text{8 lbs. per sq. ft. per hr.,}$$

so that 280 lbs. will supply

$$\frac{\text{280 lbs. per hr.}}{\text{8 lbs. per sq. ft. per hr.}} =$$

35 sq. ft. of radiation. This amount, therefore, is taken as the capacity for a 1-in. main in Table 4.

For a first floor riser at the end of this 1-in. main we can assume that it will take 10 lin. ft. more of pipe. Performing the same operation as before, using instead 110 ft. of length rather than 100 ft., when we obtain a permissible friction loss of 0.023, an indicated flow of 260 lbs., and a radiation capacity of 32.5 sq. ft. Taking this at 33 sq. ft. it is so entered on the riser table for a 1-in. pipe to the first floor.

The capacity of the other mains can now be calculated by means of their equalization values taken from Table 3. The reason that a 1-in. pipe was first taken is that its equalization value is unity and the only operation then necessary for any other pipe is to multiply its equalization value by the capacity of a 1-in. pipe. Thus for a 1¼-in. main whose equalization value is 1.75, its capacity will be

1.75 × 35 sq. ft. = 61 sq. ft.

For a 1½-in. pipe the capacity is

2.75 × 35 sq. ft. = 92 sq. ft.

A similar calculation is made to obtain the capacity of the other size mains.

Capacities for the risers to the first floor are also obtained in the same way but in this case the equalization factor must be multiplied by 33 sq. ft., the capacity of a 1-in. first floor riser. Thus, a 2-in. riser with an equalization value of 5.65 will have a capacity of

5.65 × 33 sq. ft. = 186 sq. ft.

Capacities of the risers to the upper floors depend upon their greater generating height. They have, therefore, a greater permissible friction loss. The principle to apply in this case is that from Lesson 1, where it was developed that the friction increases with the square of the velocity or quantity, or vice versa, and that the quantity varies with the square root of the friction pressure loss.

In this case the generating head from the boiler to the second floor radiators is

6 ft. + 8 ft. = 14 ft.

as against 6 ft. to the first floor radiators, or

$$\frac{\text{14 ft.}}{\text{6 ft.}} = \text{2.33 times as great.}$$

The friction pressure loss, therefore, can be 2.33 times as great and the flow obtained will be as the square root of this, or 1.6 times that to the first floor radiators. The capacity for all the risers to the second floor radiators may now be obtained by increasing the capacity to the first floor 1.6 times.

The third floor will have a height of 22 ft., which is 3.67 times greater than that to the first floor. The square root of 3.67 is 1.9, therefore the capacity of the risers to the third floor will be 1.9 times their first floor capacities. The fourth floor capacities are obtained in a similar manner.

It should be noted here that were this table compiled for a drop in temperature of 40° in the radiators, the generated power would be twice as great as those calculated, and all the capacities of mains and risers would be as the square root of 2, or 1.41 times as great. Too, the riser capacities cannot be the same if located near the boiler instead of at the end of the main. There is no attempt at precision, but for small homes of regular dimensions, fair results may be obtained by use of the tables.

For mains, the sum of whose flow and return varies greatly from the estimated amount of 100 ft., a correction must again be made and the tabular capacity multiplied by $\sqrt{\frac{100}{L}}$, where L = the length of main in feet.

General Discussion. Note that by using any of these three methods of design we cannot hope to secure as perfect a balanced condition as obtains with application of the balanced pipe friction method. With the increasing use and improvement in the delicate thermostatic controls, I foresee the time when heating systems may be installed without the use of radiator valves and a perfectly balanced system will then be imperative.

The three methods outlined are fair tools when properly handled. They appear simpler to master than the more precise method and this apparent simplicity has led to their adoption by many who use them blindly, resulting in many dead or cold spots, so that many contractors have become disconcerted and have discontinued installing hot water heating systems. The fact remains that the precise method lends itself readily to balanced design and positive results.

Expansion Tanks. A hot water heating system must have some means provided to take care of expansion. The means formerly widely used was an open expansion tank

and the installation was termed an open system. Instead of the open expansion tank, mercury seals, closed air pressure tanks and pressure relief valves are now used extensively, such types being termed closed systems.

In an open system the tank must have sufficient capacity to take care of all the water of expansion. In an installation of regular proportions the capacity of the tank in gallons can be taken as the quotient of the radiating surface divided by 40. Thus,

$$\frac{\text{Radiating Surface}}{40} = \text{gallons tank capacity.}$$

As a numerical example, a system with 400 sq. ft. of radiation will require a tank capacity of

$$\frac{400}{40} = 10 \text{ gals.}$$

This is a practical rule with a large factor of safety. If it is suspected that the system has an abnormally large water content, the water volume should be estimated and the tank capacity made equal to 4% of the total amount in the system. This is arrived at as follows:

From Table 1, Lesson 2, the density of water at 60° F. is 62.366 lbs. per cu. ft., and at 212° it is 59.843 lbs. per cu. ft. The expansion, therefore, will be

$$\frac{\text{62.366 lbs. per cu. ft.}}{\text{59.843 lbs. per cu. ft.}} = 1.04, \text{ or an increase of 4\%.}$$

There is no objection to an oversized tank, outside of its appearance, but a tank that is undersized often causes serious trouble and inconvenience. When the tank is too small, on heating up the system, so much of its water is carried away through the overflow pipe that, upon cooling, the water sinks below the level of the upper radiator connection and admits air into the system. Any air in the piping will produce sluggish circulation even though it is not in sufficient quantities to form a positive trap.

Tanks should be located well above the highest radiator and preferably as nearly as possible in a direct vertical line over the boiler, thus inducing a rapid elimination of air from the system. It should have an air vent and an over-flow pipe leading either to the sewer, roof or toilet flush tank. Tanks located in the attic or cold rooms should have both a supply and return connection to produce circulation sufficient to prevent freezing.

CLOSED SYSTEMS. All the systems heretofore described were presumably those known as open systems, that is, having the water in the expansion tank exposed to the atmosphere, but the same method of piping design applies to the closed system type.

In the open system, the highest temperature attainable for the water would be 212°, the boiling point in the tank itself. Theoretically a higher temperature than this could be obtained at the boiler which is under the added pressure due to the hydrostatic head. In practice, however, these temperatures are rarely reached. For extremely cold weather a higher water and radiator temperature would be of advantage and this has led to the adoption of the closed systems where the expansion of the water is utilized to create an added pressure and thus raise the boiling point. In all systems of this kind some device must be used to prevent the pressure from reaching a dangerous stage.

With a higher water and radiator temperature the unit heat emission of the radiator is increased and the surface can be accordingly decreased, thus lessening the cost of the system. Many of the manufacturers of the special devices for closed systems also claim that pipe sizes can be reduced. This is hardly good practice especially for systems over two stories in height. A general reduction in the pipe sizes would mean a design for a greater drop in temperature between the flow and return.

In the preceding examples it was noted that for a drop of 30° a ½-in. pipe was indicated for third floor radiators. To use pipes less than ½ in. would not be advisable and to reduce the size of other parts of the system would result in an unbalanced and imperfect installation. In general, it is best to design the closed system as though it were an open system. The frictional resistance is then low and circulation is readily set up with a slight fire, thus making the installation adaptable for moderately cool periods and yet have reserve strength to meet the demands of the most rigorous weather.

Explanation of Construction of Flow Chart

Following is an answer to J. B., R. A., and M. A. U., and also to several oral queries all of which related to the flow of fluids and to the construction of the Chart, Fig. 5, in Lesson 2.

To obtain a clearer idea, let us picture this flow through a tube as it exists and as it is presumed to exist for the purpose of mathematical formula. In

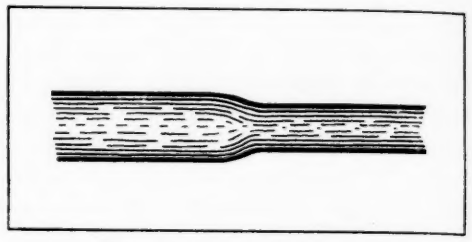


Fig. 12. Streamline Flow

relation to this term "mathematical formula" it might be well for the student to remember that mathematics in itself is not a science but rather a wonderfully potent instrument aiding the scientist to probe and express the laws of physical phenomena. Some of these physical laws are not as amenable as others and those of hydraulics pertaining to flow, due to the involved factors, defy precise mathematical expression possibly more than any others.

When a pressure is first applied to overcome the inertia of the fluid, the velocity is slight and the fluid moves in a series of parallel lines as shown in Fig. 12. This is termed "streamline" and the velocity is nearly uniform at all parts of the same cross section. We can assume that any two molecules starting hand-in-hand will continue so throughout their journey. At this stage the resistance is slight, due possibly mainly to the inertia and viscosity of the fluid, and the velocity will vary with the pressure. Doubling the pressure doubles the velocity. This same condition continues up to a certain point which is known as the point of lower critical velocity. Here the particles of water seemingly resent being thrust along and begin to cling to the side walls, and, on being torn loose by sudden shock or increased pressure, swirl aimlessly about and form eddies which increase in strength and soon the whole mass is tossing turbulently about in a condition which no known law can express, and the two little molecules that started side by side may never meet again. To the mind, speculatively and romantically inclined, every little pebble in a river's bed and every branch dipping its tendrils into the river's side at this stage, may have an important influence in the river's flow.

As the pressure is increased through

this turbulent stage another change in the flow takes place and is called the point of upper critical velocity. Here the flow again becomes more orderly and while it has a general forward direction, each particle, or group of particles, instead of moving in streamline, takes a more or less twisting path and the two little molecules that started hand-in-hand, might, by stretching and straining, continue together to the end. This is termed sinuous flow.

To build a mathematical formula for this condition would be, obviously, impossible as each particle would need a formula of its own giving due weight to viscosity, wall friction and change of direction. The only formulae then that will be of practical value are those that are obtained from experimental data, and even these must be based on a simple flow that does not exist but presumes that the velocity is the same in all parts of the cross sectional area and that the pressures on all elemental areas are the same, that

$$\frac{\text{Total Pressure}}{\text{Area}} = \text{Unit Pressure.}$$

The formulae developed by Doctor Biel have been used in the construction of the chart and have been used by the writer for years in his hot water design with gratifying results. Doctor Biel's findings have resulted in three formulae, applying to three different stages of flow which vary with the diameters of pipe used. They are

(1) $$P = \frac{0.05643LV}{d^2} \text{ for velocities below } \frac{0.158}{d},$$

(2) $$P = \frac{LV^2}{d} \times 0.893 \left(0.33 + \frac{0.226}{\sqrt{d}}\right) \text{ for velocities between } \frac{0.158}{d} \text{ and } \frac{1.382}{\sqrt{d}},$$

(3) $$P = \frac{LV^2}{d} \times 0.893 \left(0.12 + \frac{0.226}{\sqrt{d}} + \frac{0.288}{V\sqrt{d}}\right) \text{ for velocities above } \frac{1.382}{\sqrt{d}}.$$

Doctor Biel's formulae cover the influence of temperature on viscosity and with a diameter value entering into each formula, the hydraulic radius is automatically considered. In the construction of the chart the velocity term has been converted into pounds of water flowing and used as the abscissae. The density of water at 170° F. is taken as representing the general average temperature that obtains in hot water systems at extreme conditions.

The method of construction may be of interest, and a ¾ in. pipe is taken as an illustration. Taking L as unity, formula (1) becomes

$P = 0.10032\ V$, a straight line formula. Equation (2) becomes

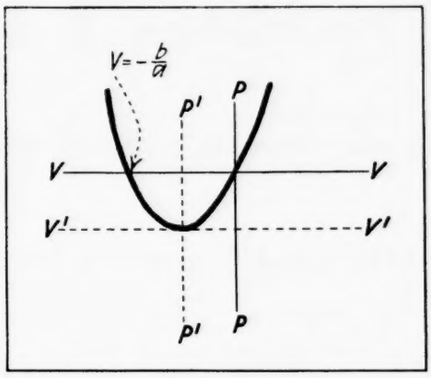


Fig. 13. Transfer of Coordinates of Parabola

$P = 0.7039\ V^2$, a parabolic curve with symmetrical origin, and equation (3) becomes

$P = 0.4538\ V^2 + 0.3961\ V$, a parabolic curve with non-symmetrical origin.

Using logarithmic paper the graph of equation (2) is a straight line and is readily obtained by calculating the friction loss for the upper and lower velocity extremes. Equation (1) would here show as a curved line but was first plotted on ordinary paper and intermediate values transferred to the logarithmic chart.

In the upper velocity range for equation (3) the graph is also a curved line and would entail endless calculations for intermediate points. By changing the point of origin to the point of symmetry an auxiliary logarithmic chart was easily made and the intermediate values transferred. The original curve is of the form

$$P = aV^2 + bV \text{ or } P = V(aV + b)$$

and when P = zero

$$V = 0 \text{ or } -\frac{b}{a} \text{ as shown in Fig. 13.}$$

Differentiating the original formula and making the right-hand member equal to zero, gives

$$\frac{dP}{dV} = 2aV + b, \text{ whence}$$

$$V = -\frac{b}{2a} \text{ at the symmetrical point of origin.}$$

Substituting this value in the original gives

$$P = \frac{ab^2}{4a^2} - \frac{b^2}{2a} = -\frac{b^2}{4a}$$

Using the point of symmetry as the origin and reducing to such form as $P = kV$ then

if we let $V = \pm\left(-\frac{b}{2a}\right)$,

then P must be $+\frac{b^2}{4a}$

and substituting $b^2/4a = kb^2/4a^2$ whence $k = a$ and the orginal equation is reduced to the form

$$P = aV^2$$

where the values of V are all increased by b/2a and the values of P by $b^2/4a$.

Thus formula (3) for a ¾-in. pipe reading

$$P = 0.4538\ V^2 + .3961\ V$$

becomes

$$P = 0.4538\ V^2$$

when all values of V are increased by $\frac{0.3961}{2} \times 0.4538$ which, reduced to pounds flowing, equals 294.0 lbs., and all values of P are increased by

$$\frac{(0.3961)^2}{4} \times 0.4538 \text{ or } 0.086 \text{ lbs.}$$

Two points then are calculated for the reduced equation and connected by a straight line on an auxiliary chart when any intermediate values can be taken off and transferred to the main chart after reducing to the true values. As an example: In order to plot the value of P for 4000 lbs. flowing, the auxiliary chart is entered for 4294 lbs., which shows a value of P equal to 18.496 which reduced by 0.086 becomes 18.41, the true value. For 9000 lbs. the auxiliary chart is entered for 9294 lbs. and the P value is reduced from 86.63 to 86.54. A number of intermediate points were thus transferred and connected by a line.

Another interesting feature developed in the graph of these equations is the rather definite boundary between the points of lower and upper critical velocities that marks the transition from streamline to sinuous flow. If the transition occurred without any disturbance then there would be some point of common velocity where the pressure would be the same whether calculated by either formula (1) or formula (2), but this is not the case and the greatest divergence occurs in the smaller size pipes. Without full data, the writer has connected the two slopes with a shorter smooth curve and lightly cross-lined this area as an uncertain state or condition. In this range the flow is apt to follow the law of formula (1) during a heating-up period and that of formula (2) when the system is cooling. The transition from the second to the third stage of flow does show a common velocity and pressure and the point of change is marked by a heavy dotted line.

Heating Troubles I Have Met

by the **TROUBLE ENGINEER**

4— Connecting Gravity and Vacuum Heating Return Lines

A HEATING contractor was called upon by one of his clients to connect a single-pipe gravity job to a vacuum line in order to bring back the returns to the power house, one half block away, across a street. This was somewhat unusual and, using his own words, had never been done before. A sketch of the layout is given in Fig. 1.

From this layout, the reader will note that building No. 1, which is an old building in which the single-pipe gravity job was installed, is located across the street from the hospital building, which has a vacuum heating system. Building No. 1 originally had its own cast-iron boiler in the basement, but when the hospital across the street was enlarged, and a new power house built, it was decided to remove the cast-iron boiler and connect the single-pipe gravity job to the vacuum heating system in the hospital building.

In order to bring the steam supply line and the vacuum line across the street, an 18-in. sewer tile was installed 2 ft. below the street level, laid on a concrete foundation, as shown in Fig. 1. In this conduit, blocks were placed to support the pipe (Fig. 3). In order to give the pipe proper pitch, each block (B) was cut a different length according to the grade of the pipe. Tile was laid level and the steam supply line, as well as the vacuum-return line, was laid on the same supports (B). Asbestos covering was placed on each length before it was screwed home.

The heating contractor was advised to remove the float air vents on the radiators in Building No. 1 and install an air-line system with thermostatic air vents on the radiators, as shown in Fig. 2. This he did and after connecting the air line to the

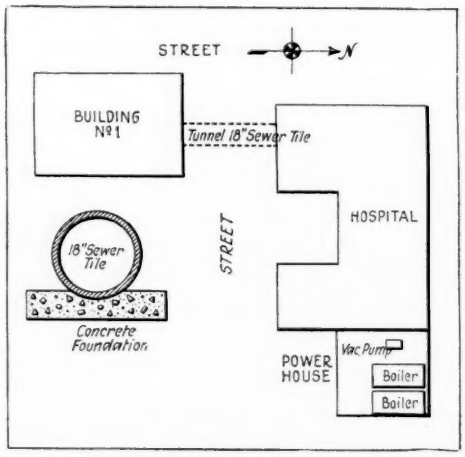


Fig. 1. General Arrangement of Buildings and Section of Tile Conduit

radiators and to the 2-in. vacuum line in the tunnel, he found that the dry and wet returns from the single-pipe gravity job offered a more serious problem, which he was unable to solve. His foreman decided to hook up all dry and wet returns to the vacuum line direct, with a thermostatic trap in this connection. This seemed to be the most plausible way out of the difficulty and instructions were given to go ahead with this proposition.

Fig. 3 shows a longitudinal as well as a cross section of the 18-in. sewer tile used for the conduit. The 4-in. steam supply line was drained by means of a 1-in. ball float trap at C in Building No. 1. The 2-in. vacuum return line pitched upwards toward the hospital building and, from point

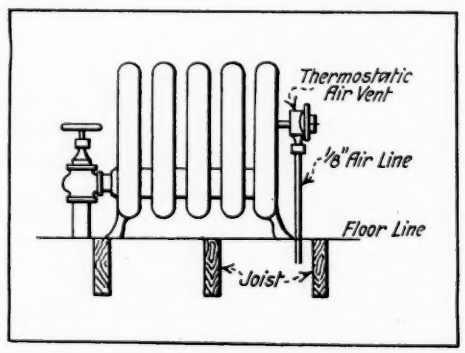


Fig. 2. Connections to Radiators of the Old Steam Type

E (Fig. 3), downward towards the boiler house. This return line was under 8 in. vacuum at all times. At point D (Fig. 3) it was carried upwards to the ceiling, a distance of 8 ft. 10 in.

When all connections had been made the job was tested. It was found that the air line system worked very well, but the steam supply to the radiators became sluggish. After 1 ½ hrs. the supply line was filled with condensation. The heating contractor removed the 1-in. ball float trap installed on the steam supply line at C (Fig. 3) and replaced it with a 1 ½-in. ball float trap. This did not help matters very much.

After several days experimenting on the job, the Trouble Engineer was called in to help solve the problem. A steam gauge was installed on the 4-in. supply line in building No. 1 and this showed 4 lbs. pressure. The vacuum line was tested and the test gauge registered 8 in. vacuum.

A thorough investigation revealed the fact that the thermostatic trap which the foreman ordered placed on the wet and dry return lines of the old single-pipe gravity job, after they were disconnected from the old cast-iron boilers, was unable to handle the condensation.

It will be remembered that no changes were made in Building No. 1 on the single-gravity job, except that the old float air vents on the radiators were replaced with thermostatic air vents and these connected to the vacuum line in the tunnel. The wet return and the dry returns were flooded because of the fact that the thermostatic trap was unable to handle all the condensation from the radiators of Building No. 1 (1,624 sq. ft. of radiation was installed in this building).

Among the steps taken to remedy the situation, the Trouble Engineer ordered a small receiving tank installed and under this tank we placed a 1¼-in. ball float trap (F) with a double-seated balanced valve (Fig. 4). After the wet and dry returns were connected to the receiving tank, as shown in Fig. 4 and the discharge from the 1¼-in. trap (F) connected to the 2-in. vacuum return line in the tunnel (Fig. 3), the job functioned so well that the pressure was reduced to ½ lb.

From the power house to Building No. 1 across the street the distance is approximately 580 ft. During the spring and fall months a vacuum of 2 in. is carried on the supply line of the system and excellent results are obtained. During the winter of 1928-29, when the outdoor temperature averaged 15° below zero for over two weeks, 1 lb. pressure at Building No. 1 was sufficient to keep all the rooms in that building up to 70 to 71°F.

In the manner described, the Trouble Engineer connected three different buildings in which a single-pipe gravity job with ordinary air vents on the radiators, an air line job and a vacuum job with traps on each radiator, were connected to a common vacuum return line with excellent results on all three buildings.

The main point is the installation of a receiving tank and a trap, as shown in Fig. 4. Care had to be taken to connect the air line ahead of the trap at H (Fig. 4) so that a vacuum would be pulled on all radiators, regardless of whether the supply valve of the radiator was opened or closed. With the air line thus connected, a vacuum was pulled on the radiator and, should the supply valve leak slightly, the condensation would be removed through the air line. In this way pounding, which occurs so often on single pipe gravity jobs when the radiator is turned on, was eliminated.

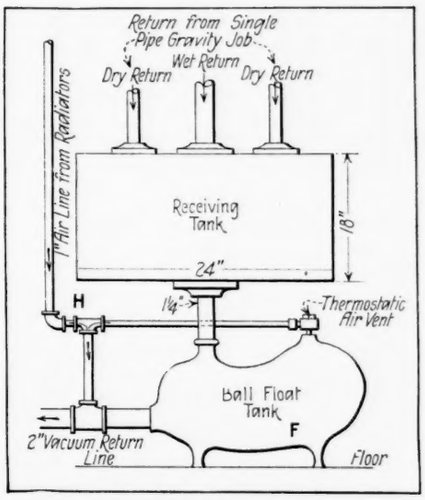


Fig. 4. Connections to Receiving Tank and Float Trap

Many single-pipe gravity jobs that did not function properly and pounded badly have been cured by the installation of air vents on the radiators and a small vacuum pump in the basement to return the condensation to the boiler. By removing the air promptly from all radiators, rapid circulation of steam takes place, which means increased efficiency of the entire installation.

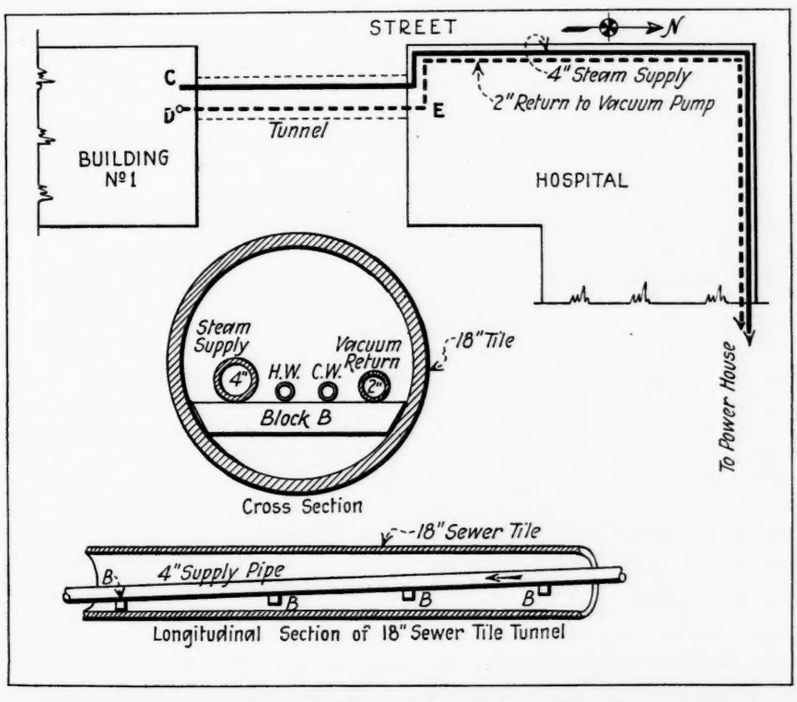


Fig. 3. Arrangement of Piping and Sections of the Pipe Conduit

Fred R. Low Retires as Editor of "Power"

For more than 40 years, Fred R. Low, as editor of *Power* has maintained the leadership for this publication. Mr. Low has observed the phenomenal progress in power generation and application, and also has played a leading part in directing this progress. In relinquishing the active editorship to Ely C. Hutchinson, Mr. Low will continue to contribute the signed editorials every week to the publication.

Mr. Hutchinson joined the McGraw-Hill organization several months ago after his resignation as president and general manager of the Pelton Water Wheel Company since 1922. In the A. S. M. E. he was one of the organizers of the hydraulic division, serving as its chairman for the first two years, and now is a member of its executive committee. He also is a member of the hydraulic power test code committee and of the library committee. Recently he was elected a member of the board of management.

Air Conditioning in Drying and Processing

"Drying and Processing of Materials by Means of Conditioned Air" is the title of a recent publication edited by B. C. Lindsay.

The first portion of the book is devoted to the theory in general, and latter portions show how the theory is applied to several specific materials. A few pages are devoted to tables of hygroscopic regain and to physchrometry —the determination of the properties of the atmosphere.

As stated by the publishers, the book is not a catalog describing apparatus or equipment, nor is it a treatise on dryer design and calculations. It offers a thorough discussion, with illustrations, of the many interesting problems involved in the drying and processing of numerous familiar materials under controlled conditions of temperature, humidity and air movement.

Published by the Carrier Engineering Corp., Newark, N. J. Size 6¼ in. x 9¼ in. Pages 208. Price $3.

Conversion Burners for Large Volume Water Heating

THE conversion burner for house-heating and water heating purposes was until recently a stepchild of the gas industry, particularly among manufactured gas companies. It was neglected and even discouraged as a means for obtaining house-heating and water heating business under any conditions. Customers were advised that they would have conversion burners installed at their own risk and service departments looked askance at requests for service on such installations.

However, with the introduction of wholesale rates for house-heating, a persistent demand was created for conversion burners among customers who desired the comforts of gas heat, who could afford the annual fuel cost, but who would not consider scrapping their coal-fired boilers while they were in good condition. At the same time, burner manufacturers developed conversion burners suitable for such furnaces which would incorporate all the automatic control and safety devices that were supplied with gas-designed house-heating equipment.

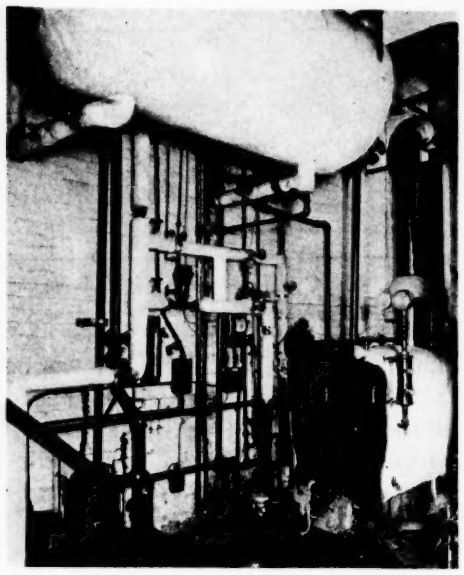
In considering the use of conversion burners for large volume water heating we are confronted with a situation which is somewhat similar to that which prevailed in the house-heating business some time ago. Use of gas-designed equipment has been resorted to almost entirely in order to insure the best possible heater efficiency with gas. Where the rates for volume water heating make gas competitive for this business it will usually be found that the cost of equipment is a resistance to sales, more serious than it is in the sale of house-heating. So gas companies have often lost business for high installation cost, but it might be possible, if conversion burners could be offered for use in connection with existing equipment, that a considerable portion of this business could be obtained.

The intensity of the desire to secure this business is indicated by the wholesale rates that have been established to attract it. It is well therefore, that our attention be directed to the application of conversion burners for water heating in order to make more complete the line of gas equipment available for that purpose and to make possible the addition of some water heating business through elimination of resistance from high installation cost.

There are many factors which introduce difficult selling problems in securing this business. The bulk of water heating in large volume must be sought in business buildings or in apartment houses which, of course, are operated for profit. Therefore, we cannot expect the prospective customer in such buildings to have the same estimate of the value of labor saving, cleanliness, and automatic temperature control that he would have if he were considering it for his home where he tends the fire and experiences the service. Of course, all these features will have potential value, but the money saving that will be granted on them to the credit of gas will depend in each case upon the existing hot water plant situation and the value of intangible advantages will probably be judged on a lower scale than prevails for domestic house-heating.

Aside from making a correct gas heater installation, the complete hot water system should be examined critically to discover means for effecting economies in operation. The use of spring faucets and thermostatic mixing valves should be recommended where needed. Leaky washers should be renewed, circulating lines should be carefully watched to see that no more circulation occurs than is necessary for good hot water service during idle periods.

Insulation should be provided for the heater, tank, hot water line and circulating line, if possible, and the thermostat should be set to maintain as low a temperature of water in storage as is consistent with satisfactory hot water service. Appliances using large quantities of hot water should be examined to make sure they are not using more water than necessary for the service they perform. In short, each entire system should be examined in all its parts for possible economies in order to make gas competitive against the lower



Installation No. 1—For Summer Water Heating in a 12-Story Office Building

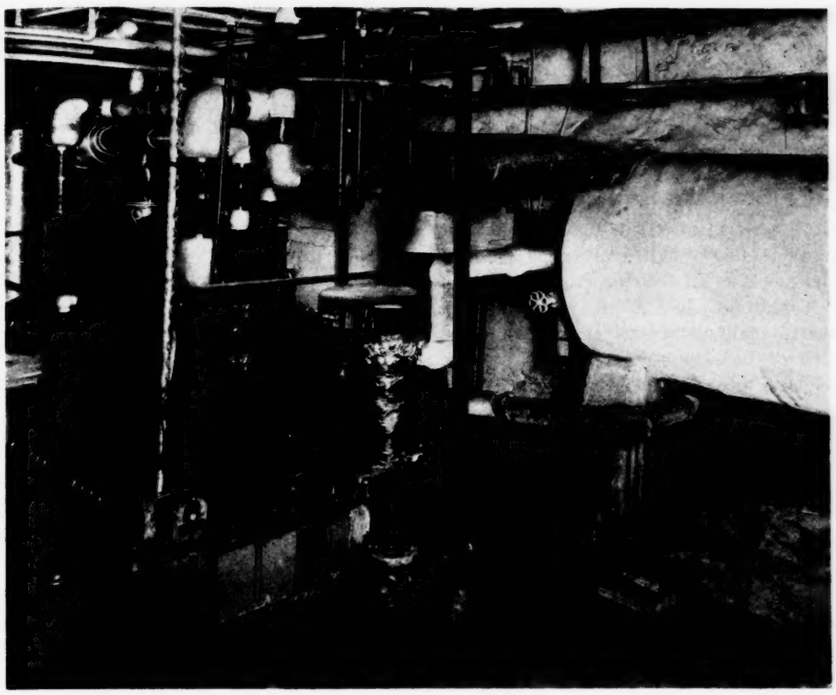
INSTALLATION NO. 1

An indirect steam system consisting of a No. 206 York low-pressure steam boiler and a 300 gal. storage tank with internal steam coils. Circulating lines are extended to all fixtures. All cold water, hot water and return circulation lines are covered with asbestos insulation. The steam and return lines are not covered. An oil burner was displaced by a No. 941S Surface Combustion burner.

Estimated maximum daily hot water requirements are as follows:

For office employees	180 x 2 =	360 gals. per day
For mechanics, etc.	10 x 5 =	50 gals. per day
For luncheonette (50 meals per day)	50 x 1 =	50 gals. per day
For cleaning purposes $\frac{25 \times 100 \times 12 \times 30}{10{,}000}$	=	90 gals. per day
Total maximum hot water required per day	=	550 gals. per day
Burner capacity installed		200 cu. ft. per hr.
Water temperature maintained		130° F.
Average gas consumption per month		55 M cu. ft.
Cost of conversion burner equipment, installed		$175
Cost of gas-designed equipment with equivalent capacity		$200

From a paper presented by A. A. Pihlman, Consolidated Gas Company of New York, at the American Gas Association, Atlantic City.



Installation No. 2.—All-Year Water Heating in a 2-Story Apartment and Office Building

INSTALLATION NO. 2

A direct system made up of a No. 15 Royal hot water boiler in connection with a 225-gal. storage tank. There are no circulating lines to the fixtures. Flow and return lines between heater and tank are covered. Hot water lines from tank to fixtures are uncovered. Stove coal was displaced by a No. 951R Surface Combustion burner. This heater had been in use for about 15 years as a hot water heater for a small house-heating system. Then after about 3 years in storage it was installed in its present position as a direct water heater, where it has been in service for 10 years.

Estimated hot water requirements are as follows:

Plumbing shop	20 gals. per day
Post office	20 gals. per day
Luncheonette (100 meals per day)	100 gals. per day
4 4-room and bath apartments 4 x 90 =	360 gals. per day
Total maximum hot water required	500 gals. per day
Burner capacity installed	200 cu. ft. per hr.
Water temperature maintained	150° F.
Average gas consumption per month	38 M cu. ft.
Cost of conversion burner equipment (installed)	$175
Cost of gas-designed equipment with equivalent capacity (complete)	$200

grade fuels which are supplied at lower gross unit costs. These rules apply to volume water heating installations whether gas designed equipment or conversion burner equipment is involved.

The volume water heating market is a low priced market and that quality is reflected in appliance installation costs for gas equipment. The cost of gas-designed equipment, installed, for converting a direct system to an indirect system might be $1,000, whereas conversion burner equipment for the same job might cost $240. The importance of keeping the cost of installation as low as possible on summer water heating equipment can be appreciated when it is considered that such equipment is in use about five months of each year. From this, it is evident that efficient conversion burners, because of their lower installation cost, would reduce sales resistance on that score appreciably and where gas rates permit serious competition with coal and oil, they should have great potential value for obtaining water heating business.

At present the gas industry is working primarily for high standards of water heating systems. Automatic temperature controls, automatic safety devices and adequate insulation are supplied and heaters are rated according to their actual output under standard conditions. Practically all systems use copper water heating elements, thus preventing the formation of rusty water in the heater. The use of cast-iron boilers for large direct water heating systems, in which the water to be heated is circulated through the boiler, is being discouraged in favor of the indirect system because of the eventual production of rust laden water throughout the system.

In considering the application of conversion burners generally for water heating, an investigation should be made of the various types of heaters now used for such purposes with coal fuel. The general practice in heating water with coal is to use the direct system for requirements up to about 5000 gals. per day. The system usually consists of a heater and tank, often uncovered, with no automatic temperature control. Some direct jobs are not even equipped with automatic water pressure relief valves, although such valves should always be supplied.

Requirements above 5000 gals. per day are usually supplied by indirect systems consisting of a house-heating steam boiler in connection with a storage tank equipped with copper coils for indirect heating. These systems are usually insulated, both heater and tank, and are often equipped with water temperature controls in the steam supply line to the tank. Requirements above 10,000 gals. per day are usually supplied by operating one of the main house heating boilers on an indirect system during the summer months and during the winter the water heating load is carried by the house-heating plant in addition.

Boilers for use on direct systems are A.S.M.E. high-pressure test boilers, tested to 300 lbs. per sq. in., and intended for operation with water pressures not in excess of 120 lbs. per sq. in. They are used in buildings as high as 16 stories but there is usually much trouble with leakage and cracked sections when used in buildings over eight stories in height. The boilers for use on indirect systems are A.S.M.E. low-pressure house-heating boilers usually operated at about 2 lbs. per sq. in. on all sizes of jobs.

Round boilers and rectangular boilers are to be found in general use. The round boilers are horizontal sectional boilers used almost entirely in installations having a hot water requirement of not more than 4000 gals. per day. They are to be found with grate diameters of from 8 in. in the small residence sizes to 28 in. for the large apartment house, etc., requirements. They are usually made up of three sections—a base, fire box and dome section with occasionally an additional intermediate section.

The heating surface in these heaters is less in proportion to grate area or output rating than it is in the average coal-fired house-heating boiler. The flue travel is very short—often there is no baffling effect whatever in the heating surface. The round boiler is practically a comparatively large combustion chamber of which the walls constitute the entire heating surface. There are a few exceptions in which a slight attempt is made to baffle the hot gases but very few have as much heating surface and baffling as the round low-pressure house heating boilers. The idea of the operation of this type of heater is to have a deep slow fire to effect heat transmission by radiation and conduction rather than to produce a rapid passage of hot gases to heat by convection.

Rectangular boilers are vertical sectional boilers with equally as much heating surface in proportion to rated heat output as the average coal-fired house-heating boiler. Unlike the round boilers there is considerable attention paid to extracting heat from hot gases by devising long flue travels and baffled heating surface. The problem of applying conversion burners to such heaters is practically the same as the application of such burners to house heating boilers.

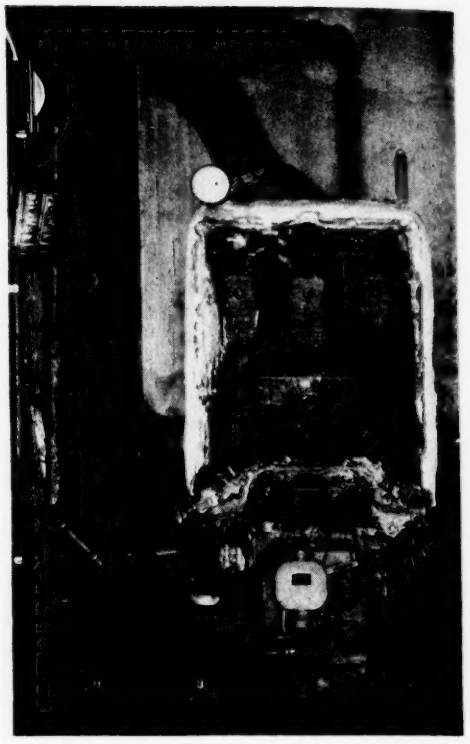
The estimating data and ratings of heaters vary widely in the coal water heating business. No accepted standard of estimating data or heater rating code seems to exist. It will be found, however, that a sort of unwritten rule prevails among the larger manufacturers of coal heaters to rate their heaters on the basis of an eight-hour firing period in terms of gallons of water per hour raised through about 25° F. Often the rating is expressed in gallons of storage tank capacity recommended to be used in connection with the heater, in which case the same figure for expressing the water heating capacity, in gallons per hour through 25° F., is used to express the recommended storage tank capacity. It seems that the temperature rise of 25° F. was selected as a basis of rating because it provided a figure for expressing gallons per hour capacity which could also be used to express the recommended storage tank size for that general class of water heating jobs, residential buildings.

From the above it will be noted that, according to manufacturers' recommendations, heaters are installed which have a rating in gallons per hour raised through 100° F., equal to ¼ of the storage tank capacity. This proportion of heater size to storage tank is considered to be good practice in the gas industry for residential buildings. So we can expect to find well proportioned systems installed where responsible architects and heating contractors have investigated the hot water requirements seriously.

For estimating data, the large manufacturers use a figure of from 30 to 40 gals. per hr. of heater capacity or 30 to 40 gals. of storage tank capacity per bath in residential buildings. For other types of buildings unit figures per fixture are used, tempered by the experience of the individual company. No uniform data on requirements other than residential buildings seem to exist for coal-fired water heating. Considering the data in common use for estimating residential building requirements it is evident that ample storage tank and heater installations are made, judging from our experience with similar buildings using gas equipment.

Assuming that conversion burners are not to be recommended where a complete gas designed installation can be made for equal cost, we may consider that any installation which can be completed for less than $200, including gas-designed heaters, thermostat and relief valve, should not be considered for a conversion burner. Circulating copper coil heaters may be installed to take care of an eight-family apartment house having five-room and one-bath apartments, or any job having an estimated maximum daily hot water requirement of 800 gals. per day, for the above cost.

For jobs immediately larger than this a round boiler will usually be found with the short flue travel and plain, unbaffled and scant heating surface described previously. These heaters will certainly require baffling for directing hot gases from a conversion burner to the heating surface in order to get the best efficiency possible under the circumstances. The fact that the heater is ample in size with coal fuel and the probability that it has been installed oversize to accommodate irregular firing is in favor of the conversion burner. A larger heater means more heating surface, but in any event the baffling must be installed more carefully than is required for house-heating boilers because of the unsuitable natural arrangement of the heating surface.



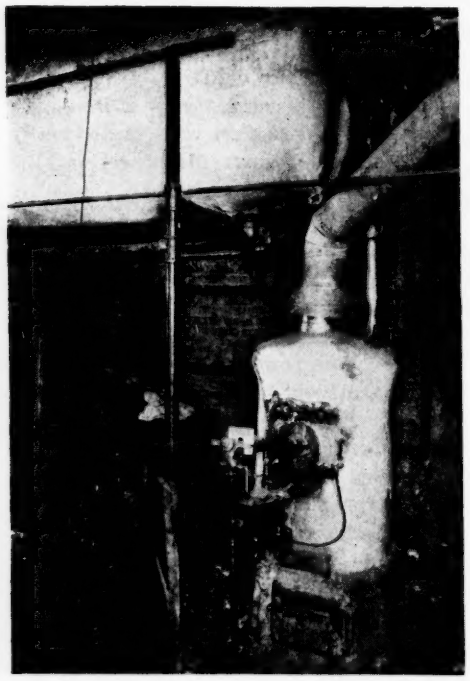
Installation No. 3—All-Year Service in a 2-Meal Restaurant

INSTALLATION NO. 3

A direct system consisting of a No. W217 Burnham hot water boiler in connection with a 450-gal. storage tank. No circulating lines to the fixtures. Heater and storage tank are covered with asbestos insulation. No piping is insulated. Stove coal was displaced by a No. 943S Surface Combustion burner.

Estimated maximum hot water requirements are as follows:

900 meals served per day—average cost $1 per meal—dishes washed by machine	900 x 2 = 1800 gals. per day
Burner capacity installed	600 cu. ft. per hr.
Water temperature maintained	170° F.
Average gas consumption per month	80 M cu. ft.
Cost of conversion burner equipment (installed)	$225
Cost of gas-designed equipment with equivalent capacity (installed)	$650



Installation No. 4—All-Year Water Heating in a 12-Story Office Building

INSTALLATION NO. 4

A direct system consisting of a No. 15 Ideal hot water boiler in connection with a 420-gal. storage tank. Circulating lines extend to all fixtures. Heater and storage tank are insulated but no piping is covered. Buckwheat coal was displaced by a No. 3 Cheney burner.

Estimated maximum hot water requirements are as follows:

For office employees	300 x 2 = 600 gals. per day
For mechanics, etc.	15 x 5 = 75 gals. per day
For luncheonette, 200 50c-meals per day (hand dish washing)	200 x .5 = 100 gals. per day
For cleaning purposes $\frac{75 \times 100 \times 12 \times 30}{10{,}000}$	= 270 gals. per day
Total maximum hot water requirement	=1045 gals. per day
Burner capacity installed	200 cu. ft. per hr.
Water temperature maintained	150° F.
Average gas consumption per month	63 M cu. ft.
Cost of conversion burner equipment installed	$175
Cost of gas-designed equipment with equivalent capacity installed	$200

The conversion burner should include all possible features for obtaining complete automatic control of water temperature and for assuring absolute safety. The following features should be provided:

Primary and secondary air control.
Automatic gas pressure control.
Automatic water temperature control.
Automatic safety pilot device.
Device for preventing back drafts in flue.

In view of the fact that these installations might often be made in buildings in which a coal-fired boiler is maintained for house-heating, it is recommended whenever the water heater is to be operated throughout the winter, and is to be vented into the same flue stack with the house-heating boiler, that the flue from the gas heater be run separately to the chimney stack and that the point of entry of the gas flue be kept at least 12 in. above the point of entry of the coal heater flue.

With such short flue travel as is provided for in coal heaters it is important that very little chimney draft be applied to the heater. The method of providing against back drafts usually provides for checking the draft at the heater, but this feature should be given careful attention.

Application of conversion burners for rectangular boilers is practically the same as that outlined for round boilers. The same care should be taken with all features involved, but better results should be obtained with this class of heaters because of the proportionately greater and better arranged heating surface. The heating surface on some coal-fired water heaters amounts to 1 sq. ft. per 3000 B.T.U. per hr. actual output rating, which compares favorably with that of the best gas-designed boilers.

A short experience with several conversion installations on both round and rectangular boilers in buildings including restaurants, apartment houses and office buildings indicates that hot water service, satisfactory both as to quality and cost of operation, can be rendered. Not enough data have been collected to form conclusions as to the relative performance of the conversion burners with the probable performance of gas-designed equipment on the same jobs, but this much we know—those jobs, on which conversion burners were sold, were obtained immediately due to the low cost of equipment required, whereas, if gas-designed equipment only had been offered, the sales would have been at least delayed, probably indefinitely.

In order that some definite idea of the results being obtained with conversion burners may be obtained, the following data is submitted. The gas used is a mixed gas having a calorific value of 540 B.T.U. per cu. ft.

No water meter readings have been available on any of the above jobs so our opinions at this time must be based on estimates of hot water consumption. From the average gas consumptions noted it can be seen that the operating efficiency is within close range of that with gas-designed equipment for similar hot water requirements. It will also be noted that, while we recommend insulation of all hot water and circulating lines, that is not always done, at least, not immediately. In all the above instances, the customers are well satisfied with their present hot water service and its cost, but of course, the gas company serving them will not be satisfied until all features which tend toward economy have been attended to.

An interesting point about the installations described here is that four of the five were originally sold as summer water heating jobs. The satisfactory operation of No. 2 and No. 5 was largely responsible for house heating installations being made in those cases. In the case of No. 3 the operation has been extended from summer water heating to all year water heating because of the advantages which gas heated hot water service offered.

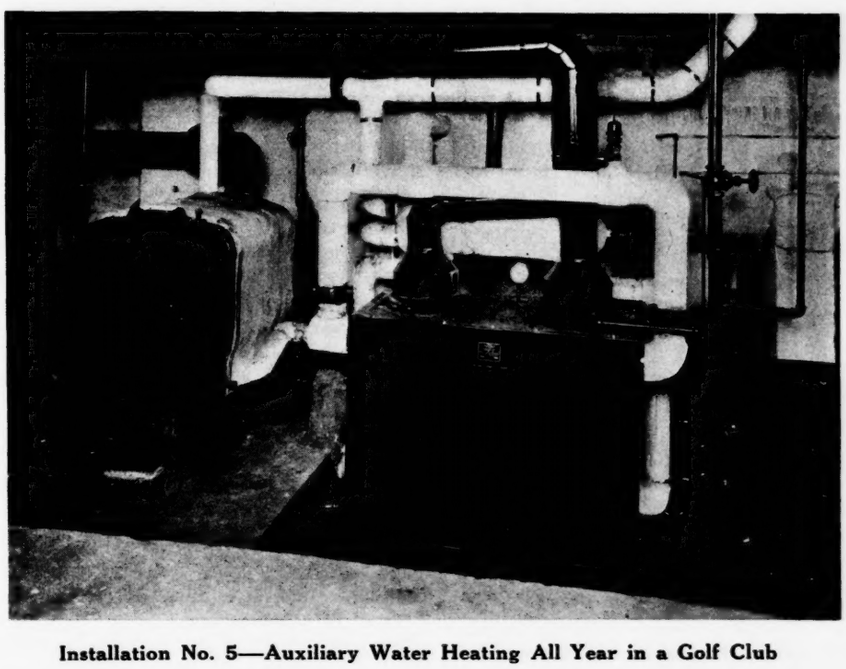
In the promotion of volume water heating with the use of conversion burners it should be kept in mind that the plumbing trade in every community is probably the most consulted body on the water heating problems of prospective customers who are ready to act. *It is good policy, therefore, to provide some attractive features in the promotional plan of water heating sales for interesting the heating and plumbing contractors in the sale of conversion burners.* If the plumbers were to make installations, the burners might be sold at a discount to them and supervision provided for the jobs, that they may proceed to satisfactory conclusions without delay. If the gas company were to make the installation, a productive lead compensation would be 100% profit to the plumber.

Even with such features in a plan for promoting the sale of conversion burners, the plumber's primary interest will continue to be in the sale of gas-designed equipment because in such jobs the discounts on appliances and profits on connection charges amount to much more than would be received from the sale of a conversion burner for the same job. So, with the plumber, as with the gas company, gas-designed equipment will be promoted primarily, and conversion burners will be used to obtain business only when the higher cost of gas designed equipment has apparently stopped a sale.

INSTALLATION NO. 5

Originally a direct system consisting of a coal-fired No. 720 York hot water heater in connection with a 1000-gal. storage tank. It was displaced by a gas-designed indirect system consisting of a gas steam boiler in connection with an external indirect heater. With an increase in the hot water requirements of the building it became necessary to provide additional hot water heating capacity and because of the small expense involved a No. 943S Surface Combustion conversion burner was installed in the old coal heater to make up the additional heating capacity required. This heater is used only during peak loads and is not separately metered.

Cost of conversion burner equipment installed.....$225
Cost of gas-designed equipment with equivalent capacity.....$650



Installation No. 5—Auxiliary Water Heating All Year in a Golf Club

Control of Humidity and Temperature

As Applied to Manufacturing Processes and Human Comfort

by **WILLIS H. CARRIER,**
President, Carrier Engineering Corporation

III

Air Conditioning Equipment

AIR conditioning equipment comprises:

1. Apparatus for providing the necessary heat and moisture exchanges within the room to be conditioned and of the air supplied to the room for ventilation.

2. Automatic devices for governing such apparatus so that temperature and humidity may be controlled within the limits desired.

The latter are referred to as controls. Those for controlling temperature are known as thermostats, and those for controlling humidity are known variously as hygrostats, psychrostats, or humidostats.

Apparatus for effecting humidity changes may be divided into two distinct groups:

1. The humidifiers used for the purpose of increasing the moisture content of the air and to produce cooling by evaporation.

2. The dehumidifiers used for the removal of moisture from the air and to produce cooling by contact with water or surfaces at a lower temperature than the air.

Humidifiers may be divided into the following general types according to the method of operation:

1. Indirect (Introduction of moistened air).
2. Direct (Spraying into the room).
3. Combined (Direct and indirect).

Before the advent of modern air conditioning the direct type humidifier was largely used for increasing the humidity in cotton mills and similar places. There has been much improvement in this type of humidifier and they still find wide application, especially in the textile industry.

One of these types uses atomizer heads operated by compressed air in which the water is drawn into the nozzle and then finally atomized by a small jet of air under high pressure. This type is illustrated in Fig. 3.

In another type, water is supplied at high pressure (usually about 200 lbs. per sq. in.) to an atomizing nozzle. This nozzle is located in a sheet-metal enclosure suspended from the ceiling through which a current of air is caused to pass, either by the action of a motor driven disc fan or by the induction action of the spray itself. The heavier particles of water are separated by a simple method of baffling and only the very finest particles are caused to pass into the room with the current of air where they are rapidly evaporated. This type is shown in Fig. 4.

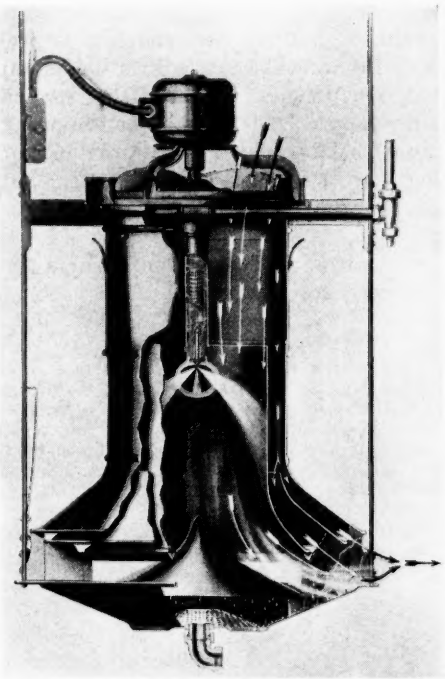


Fig. 4. One Type of Humidifier Head

In a third type of direct humidifying head a small jet of water is thrown upon a disc rotating at high velocity within a stationary circular comb which consists of fine metal strips or teeth against which the water thrown from the disc

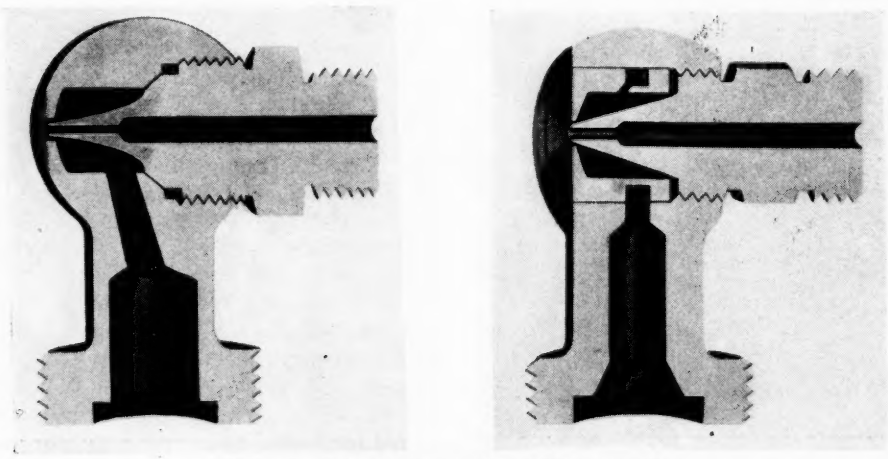


Fig. 3. Direct Type Humidifier Heads

From a paper presented at the World Engineering Congress, in Tokio, Japan, November 7, 1929.

impinges. The finely atomized particles that are thus provided are carried out with the current of air created by a disc fan operated from the motor shaft. This type is illustrated in Fig. 5.

The three types of direct humidifiers described are suitable only for application in certain types of industrial plants and do not provide either for controlled ventilation or for dehumidification, which is essential in many industries as well as for applications providing for human comfort.

Indirect humidifiers are similar in operation to the spray-type air washers except that the water is sprayed directly against the incoming air. Such humidifiers comprise a chamber, usually from 6 to 8 ft. in length, through which the air is drawn at a velocity from 500 to 700 ft. per minute. Inside the chamber are placed one or more banks of spray nozzles distributed uniformly over the cross sectional area of the chamber. These nozzles create a finely-divided spray through centrifugal action and require water pressures for effective humidification of from 35 to 45 lbs. per sq. in.

At the intake of the humidifying chamber a set of baffles distributes the air and prevents the spray from escaping from the chamber, while at the outlet of the humidifier chamber an eliminator is provided. This eliminator, consisting of a series of metal baffles, is so designed as to separate all of the free, unevaporated moisture from the humidified air. Thus, the air leaving the humidifier is completely saturated, but without any entrainment or unevaporated water particles. The general construction of this type of humidifier is shown in Fig. 6.

Such humidifiers are used only in connection with ventilating systems. They are practically always placed on the inlet side of the ventilating fan. Provision is made for warming the water in winter so that the air may be saturated at a definite temperature. The heating of the water is usually controlled by means of a thermostat placed in the path of the saturated air leaving the humidifier and controlling the heater through which the spray water passes.

In other cases, particularly in industrial work where high humidities are maintained, the control of the dew-point temperature is effected by a thermostat controlling the mixture of outside air and return air from the building by means of fresh and return air dampers at the inlet of the humidifier.

In industrial work, the dew-point regulation is effected in winter time by both of these means operating in conjunction. Where all outside air must be employed, it is usual to provide in front of the air washer, certain preheater coils of sufficient capacity to bring the air to a temperature slightly above the freezing point.

In summer time operation, whenever the outside wet-bulb temperature is above the minimum dew-point desired in the building, all outside air is taken and, it will be remembered from the psychrometric principles previously discussed, that the air issuing from the humidifier will have been cooled to the wet-bulb temperature of the entering air, provided, of course, that the water is neither heated nor cooled by recirculation, which is usually the case in such installations.

In most manufacturing processes relatively little moisture is added to, or extracted from, the air in the room by the process itself and, as windows and doors are closed, conditions in the room rapidly stabilize to the moisture content of the entering air. Thus, it is possible to control the relative humidity within the room by proportioning the quantity of the air in accordance with the heat sources within the room, such as heat from machinery and the occupants, electric lights, sunlight and outside radiation. The quantity of air to be supplied for each unit of heat thus removed is definitely dependent upon the relative humidity to be carried.

For example, if 50% relative humidity is to be carried in the room, the ventilation must be restricted so there shall be a rise of 20° between the entering air and the air in the room itself. Smaller rises would give increased relative humidities.

In textile mills, for instance, with the humidities usually carried, it is possible to keep the room temperature within about 12° of the outside wet-bulb temperature. Inasmuch as the wet-bulb temperature on hot days is usually 15° to 25° lower than the dry-bulb temperature, the mill temperature will be below the outside temperature and provision has to be made for the heat absorbed by inward transfer of heat through the walls. The general design of such a system of humidification and air conditioning is shown in Fig. 7.

The type of humidity control described is usually known as the *dew-point* control and is particularly applicable where there are a number of different departments to be served from one central equipment, and where there is but little change in the moisture content of the air in the room, due to moisture changes in the materials processed or to excessive air leakage from outside.

Another system that is used considerably, especially where there is but one room to be controlled from one apparatus and where there may be considerable moisture change in the room itself due to local conditions, is to vary the dew-point at the apparatus, either continuously or intermittently, by means of a hygrostat placed in the room and so connected as to vary either the temperature or quantity of spray water used

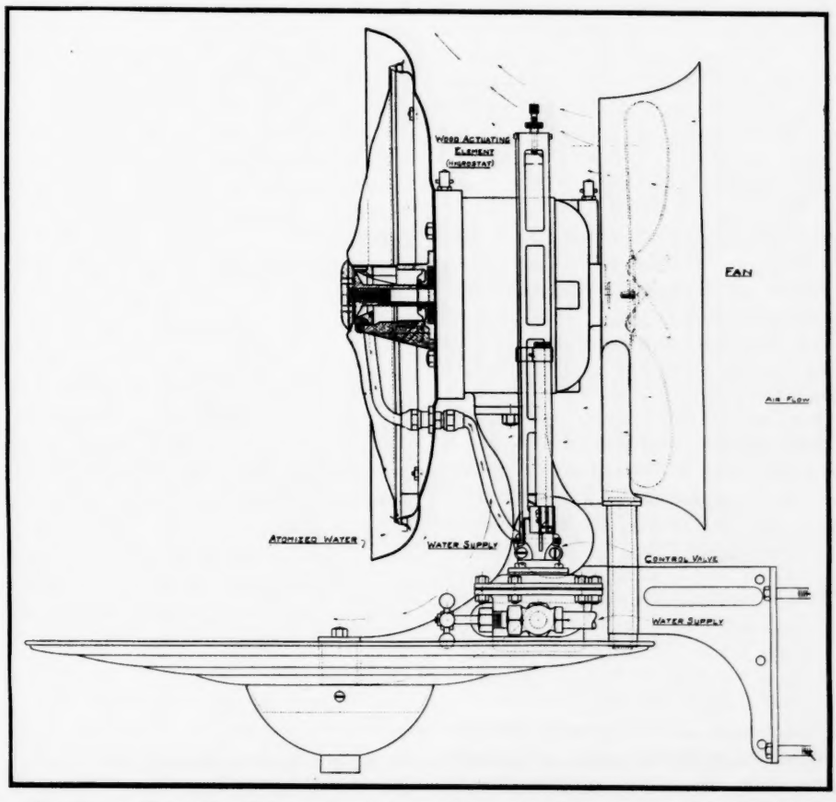


Fig. 5. In This Humidifier a Small Jet of Water Is Thrown on a Rotating Disc

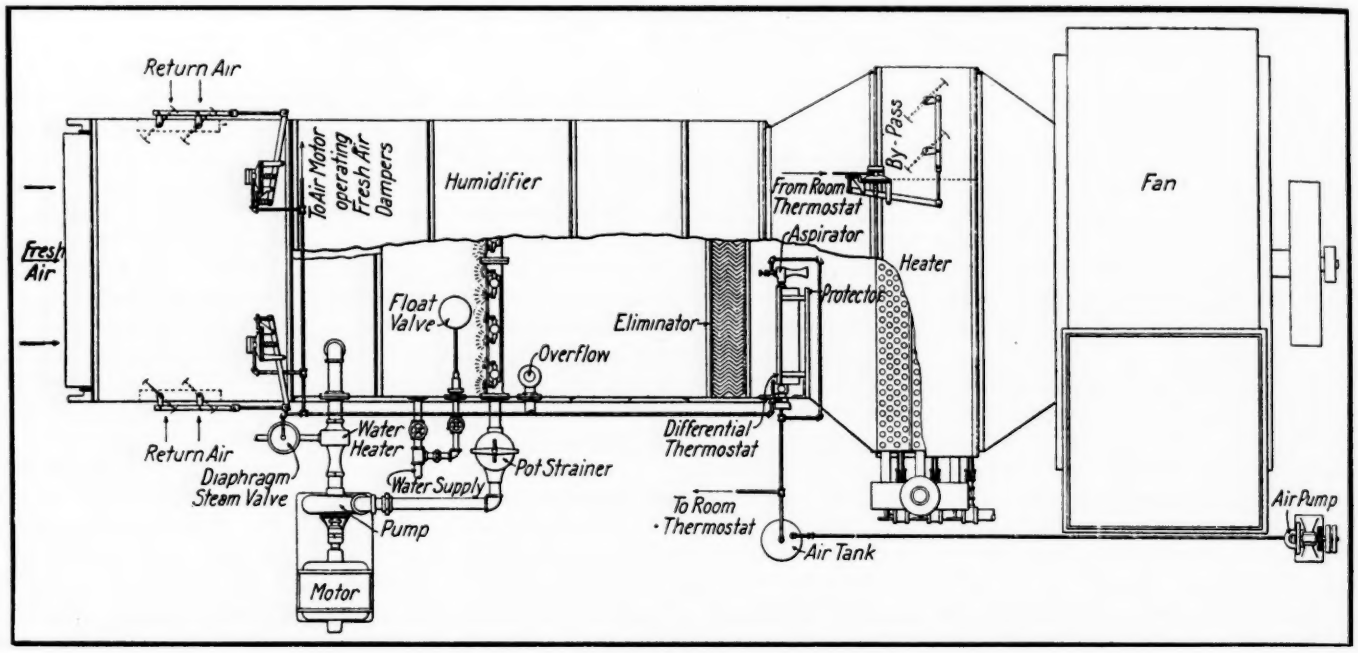


Fig. 6. Plan of Humidifier with Humidity Control

in the humidifier, or both. This system may be designated as the *direct relative humidity* control.

In such installation the temperature and humidity are both under control during the heating season, and in the summer time the humidity must be maintained constant but the temperature must be allowed to rise in accordance with the increase of the wet-bulb temperature above the minimum desired. Temperature variations under mill conditions will be from 75° to 90° F.

Such results are much superior from the standpoint of comfort and well-being of the operators than those previously experienced. This has resulted in greatly increasing the effectiveness of the workers during this period, but the amount of ventilation provided has also greatly improved conditions in mills as to dust, lint, and odors.

In the spinning of fine cotton yarns, this is of great value in producing an improved product, as well as in bettering working conditions.

The uniform degree of air motion results in the lowering of the effective temperature with a consequent increase in comfort and efficiency of the workers at temperatures and humidities which are necessarily high because of the requirements of the product. The motion results also in removing the heat directly and immediately from the point of production on the spinning frame thus avoiding localized increase of temperature and decrease of relative humidity. In other words, it permits the entire process to be subjected more nearly to the average room conditions.

Where large quantities of power are generated in a limited space, and where higher than 60% relative humidity is required it is feasible and economical to use a combination of direct and indirect humidification. The indirect humidification is for the purpose of securing the desired quantity of ventilation and cooling, and the additional direct humidification placed in the rooms to increase the humidity and, at the same time, secure additional cooling effect. In general it may be stated that direct humidification is most satisfactory where higher humidities with but little cooling or ventilation are required.

Therefore, the indirect system is best where lower relative humidities with maximum cooling and ventilating effects are desired, while for conditions where there are large quantities of heat to be absorbed by ventilation and high humidities are needed, the combination system of direct and indirect is more desirable.

Inasmuch as the cooling and humidification requirements in summer are much more severe than those in winter, an excess of humidifying and cooling capacity must be provided to meet extreme conditions and this requires, for the best results, careful automatic control. Such applications of humidity control may be considered standard practice today in the United States.

The same type of equipment as used in cotton mills is largely applicable to other textile industries, including rayon, and also to tobacco factories, paper mills, and other buildings.

In the concluding part of Mr. Carrier's paper, which will be published in the March issue of HEATING AND VENTILATING, the author discusses the various systems of dehumidification and air distribution, unit air conditioners, and humidity controlling devices.

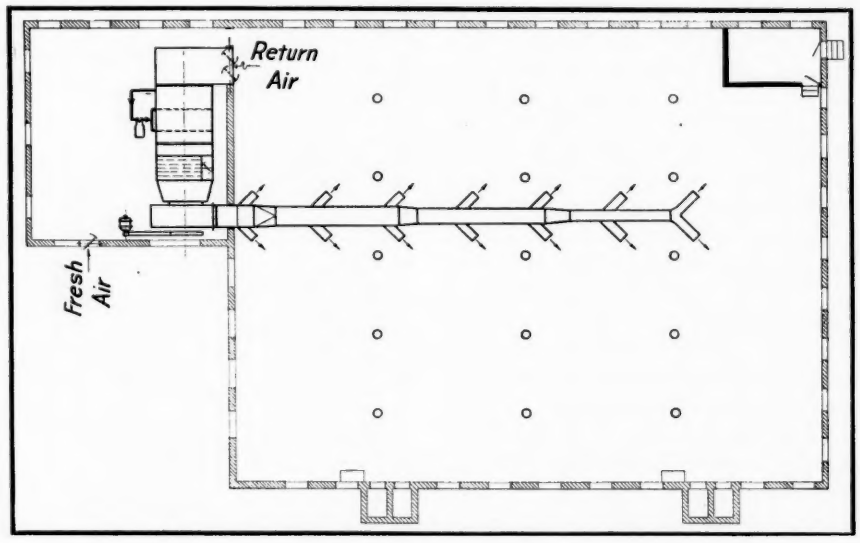
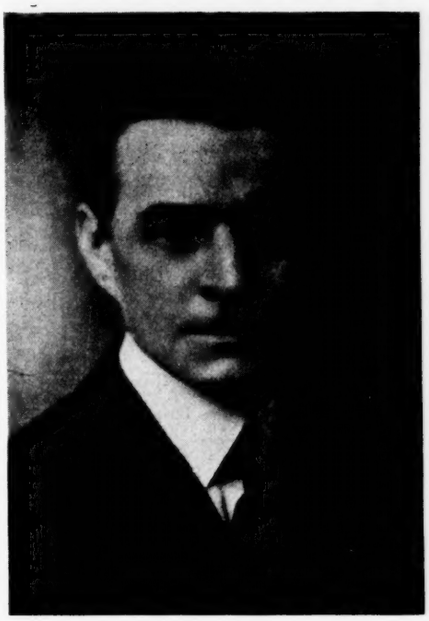


Fig. 7. General Arrangement of One System of Humidification and Air Conditioning

American Society of Heating and Ventilating Engineers

Boiler Rating Code High Note of A.S.H.V.E. Annual Meeting



L. A. Harding, Newly-Elected President of the Society

IN the glamour of the First International Exposition, which attracted crowds estimated conservatively at over 50,000 people, the American Society of Heating and Ventilating Engineers established a new high record for attendance at its 36th annual meeting, held at the Benjamin Franklin Hotel in Philadelphia, January 27-31, 1930. No less than 1063 members and guests were registered and many more were in attendance who came on only for the exposition. Long before the meeting got under way, the large number of hotel reservations gave some inkling to those in charge of the arrangements of the size and character of the event.

In spite of the fact that the Commercial Museum, where the exposition was held, is located a mile and a half from the hotel, the exposition attracted an increasing number of visitors, reaching a high point Thursday, the 30th, when over 17,000 tickets were turned in for the day.

In addition to the many notable research papers presented at the technical sessions of the meeting, the society took a number of important actions, including the adoption of a code for testing and rating unit heaters.

Undoubtedly the high spot of the meeting was reached Thursday morning when Chairman L. A. Harding of the Continuing Committee for the Rating and Testing of Low-Pressure Steam Heating Boilers, presented his report which included a slightly revised draft of the proposed boiler code presented at last summer's meeting of the society. The item of fuel-gas temperature had been added at the request of the council and a paragraph inserted to the effect that, "the manufacturer shall print in bold-face type or otherwise designate the output of each boiler corresponding to the design load to which the boiler is intended to be connected, as determined by the provision of Section V of the A.S.H.V.E. Code of Minimum Requirements for the Heating and Ventilating of Buildings."

As usual, the boiler rating code aroused a lively discussion which was participated in principally by the steel heating boiler interests. The discussion turned on whether the code should provide for a one-number or multiple-number rating, and also on whether it should be a performance code, rather than a dimensional code.

Since the last summer meeting of the society, as Mr. Harding pointed out, the Steel Heating Boiler Institute has promulgated a dimensional code for the rating of heating boilers, which Mr. Harding discussed at length in his report. He called particular attention to the fact that the code makes no mention either of tests, type of solid fuel, calorific value of the fuel to produce the rating or any guarantee by the manufacturer as to actual output.

Before the discussion got under way, C. E. Bronson, of the Kewanee Boiler Corporation, presented the steel boiler manufacturers' point of view in a paper on "The Rating of Heating Boilers by Their Physical Characteristics."

It was apparent that there was a considerable division of opinion on the subject, and at the conclusion of the discussion it was voted to refer the proposed A.S.H.V.E. Code for Rating Steam Heating Solid-Fuel Boilers to the members for vote by letter ballot. Therefore, it will be 60 days or more before the fate of the proposed code is known.

A welcome surprise was sprung by Chairman L. A. Harding, of the Committee on Research, when he announced that Thomas J. Duffield, until recently executive secretary of the New York Commission on Ventilation, had been appointed executive secretary of the A.S.H.V.E. Committee on Research. Mr. Duffield not only will contact the various institutions, which are cooperating with the society in research work, but will assume some of the other arduous duties which have fallen upon the shoulders of the chairman of this important committee.

As early as Saturday night preceding the meeting, delegates commenced to gather at the Benjamin Franklin Hotel, where the morning sessions of the meeting were held. The afternoon sessions were held at the Commercial Museum. Under the direction of R. C. Bolsinger, general chairman, the Philadelphia Chapter had made elaborate preparations for the entertainment of its guests. Not only was the entertainment program unusually full and well-handled, but the prizes and souvenirs established a new standard in the way of novelty and beauty.

One of the outstanding inspection trips was that of Monday afternoon, when the delegates visited the Frost Research Laboratory, in Norristown. Another event which proved of great interest was a historical trip to Valley Forge, where the party, in charge of F. D. Mensing, was taken over the encampment grounds occupied by the Continental Army under Washington, during the memorable winter of 1777.

No less than eight papers on the program detailed the results of research work conducted at the A.S.H.V.E. Research Laboratory or at institutions working in cooperation with the Research Laboratory.

It is worthy of comment that fifteen ex-presidents of the society attended the meeting, including Stewart A. Jellett, T. M. Quay, Reginald Pelham Bolton, Harry M. Hart, Samuel R. Lewis, Dr. E. Vernon Hill, Dean F. Paul Anderson, John E. Hale, Prof. A. C. Willard, Jay R. McColl, J. I. Lyle, Samuel E. Dibble, Dwight R. Kimball, H. P. Gant and Homer Addams.

All of the proposed amendments to the by-laws were adopted, including one providing for the establishment of an endowment fund "for research and such other purposes devoted to the art of heating and ventilating, as may be determined by the council."

The time and place of the next semi-annual meeting was fixed as June 24-28, at Minneapolis, Minn.

MORNING SESSION, JANUARY 28

The first general session was held in the ballroom of the Benjamin Franklin Hotel, Tuesday, January 28. John Cassell, chief engineer, Philadelphia Board of Education, delivered the address of welcome for the Philadelphia Chapter. Indicative of the splendid hospitality displayed by the members of the chapter, Mr. Cassell told the assembled guests that if there were any points of interest, any buildings or any plants which any of the guests wished to inspect, and which were not listed on the program, the entertainment committee would be very glad to arrange that such places could be visited by those interested.

Inasmuch as President Lewis is a member of the local chapter, the response for the guests was made by L. A. Harding, of the Western New York Chapter. Mr. Harding remarked that Benjamin Franklin was not born in Philadelphia, but in Boston, and that the only answer the Philadelphians could make to this was that Franklin couldn't help it.

Greetings to the society were read from Secretary of Commerce Lamont and also from the president of the Philadelphia Chamber of Commerce.

The report of the tellers indicated that the nominees for officers and members of the council had all been elected, with but a few scattered votes.

In his report, President Lewis commended all of the officers of the society for the hearty support they had given during the past year and paid a tribute to the secretary of the society, A. V. Hutchinson, who, Mr. Lewis said, never forgets anything, is everywhere, and is at all times working wholeheartedly for the good of the society.

L. A. Harding presented the first paper of the meeting, "Power from Process and Space Heating Steam."

Power from Process and Space Heating Steam

In this paper the author, dealt only with the specific problem involved in the generation of electric power from process steam. He discussed at length the means that can be adopted for securing as near a balance as possible between the heat available and the heat equivalent of the power requirements obtained with a minimum amount of expense for extra fuel. He took, for example, a case where there were found, on comparing the available process steam load and the power load curves and assuming a certain prime mover to be employed, a deficiency of approximately 15% of the steam available for power generation. He showed that this deficiency can be met in any one of three ways:

1—Increasing the boiler pressure to 175 lb. per sq. in. absolute or an increase of 25 lb. per sq. in.

2—Superheating the steam 150°.

3—Reducing the process (back) pressure to 47 lb. per sq. in. absolute, or a reduction in the process pressure of only 8 lb. per sq. in.

Increasing the boiler pressure would in all probability require the installation of new boilers, an expensive procedure. Superheaters, if the plant is equipped with water tube boilers, could be installed at nominal expense but would require approximately 7% more fuel for superheating. The reduction in back pressure, if at all possible, would obviously be the natural procedure, as the slight difference in temperature resulting from the reduction in pressure would probably have comparatively little effect on the process.

If, however, the deficiency in process steam available for power generation amounted to say 40%, then it is apparent that the boiler pressure must be increased to 225 lb. per square inch absolute or increased a smaller amount and some superheat employed, or use 310° superheat with no increase in pressure, or reduce the process pressure to 36 lbs. per sq. in. absolute (21 lb. gauge), a reduction of 17 lbs. per sq. in. In this case the installation of new boilers designed for the higher pressure and equipped with superheaters would probably be the outcome.

Data in this paper refer particularly to the use of steam turbines for use in plants from 200 to 1500 kw. capacity both for non-condensing and condensing operation, as well as on extraction or bleeder turbines.

Under the heading of "Exhaust

New Officers

President, L. A. Harding, Buffalo, N. Y.; first vice-president, W. H. Carrier, Newark, N. J.; second vice-president, F. B. Rowley, Minneapolis, Minn.; treasurer, C. W. Farrar, Buffalo, N. Y. Members of the council, three-year term:

R. H. Carpenter, New York; John D. Cassell, Philadelphia, Pa.; Alfred Kellogg, Boston, Mass.; John Howatt, Chicago, Ill.

Thomas J. Duffield,
New Executive Secretary of the Committee on Research

Steam Space Heating," Mr. Harding had some interesting things to say on steam versus hot water systems. When turbine exhaust steam is to be employed for space heating, considerably more electrical power, he showed, may be generated with a hot water system than with a vacuum steam system on account of the fact that a lower back-pressure may be carried at the turbine. Mr. Harding presented an example to prove this point.

In the discussion on Mr. Harding's paper, John W. Meyer, manager of the Steam Heat Sales Division of the Philadelphia Electric Company, cautioned the members to be very careful in the determination of the steam and electric load curves. He pointed out that at one extreme the steam load would follow the electric load exactly but that at the other extreme the opposite would be the case and the exhaust steam would be lost. The success of the whole problem depends on the accuracy with which the steam and electric load curves are determined, followed, and applied.

The report of the Council, read by A. V. Hutchinson, stated that many special committees are at work on such subjects as the Society Endowment Fund, the Code for Testing Unit Heaters, the Code for Testing Concealed Heaters and the Code for Testing Unit Ventilators.

An increase of 241 members resulted from the national drive for membership, according to the report by Cecil W. Farrar. The total membership is now 2192.

AFTERNOON SESSION, JANUARY 28

For the Finance Committee, Chairman W. T. Jones gave some interesting figures on the operation of the society. Gross profits on the A.S.H.V.E. *Guide* for 1929 were $12,000, while the net profit was $4973. Receipts by the society for the year were $39,000 and the disbursements $38,963. The new arrangement for the publication of the *Journal* netted the society $7508 for the eight-month period it has been in effect.

The remainder of the session was given up to reports on cooperative research on "Pressure Difference Across Windows in Relation to Wind Velocity," by J. E. Emswiler and W. C. Randall, and "Air Infiltration Through Various Types of Brick Wall Construction," by G. L. Larson, D. W. Nelson, and C. Braatz.

MORNING SESSION, JANUARY 29

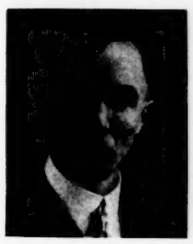
In the report of the Committee on Research, Wednesday morning, Chairman L. A. Harding explained that the duties in connection with the work of the committee were becoming so arduous that it was difficult to expect the individuals on the committee to carry on the work the way it should be. He said that the council had considered the employment of a full-time paid executive secretary and that Thomas J. Duffield, formerly executive secretary of the New York Commission on Ventilation, had been chosen for the position. Mr. Harding introduced Mr. Duffield, who will assume his new duties February 1.

F. C. Houghten, Research Director, then presented his report. He told of the activities of the Research Laboratory and of the cooperative research being carried on at various universities under an arrangement with the society. Among these is the experimental work being carried on at Sheffield Scientific School of Yale University on oil burners, in an attempt to develop a standard method of testing oil burners, of determining proper sizes of combustion chambers, etc.

The report of the Association for Correlating Thermal Research was presented by Joseph C. Fitts, chairman. Mr. Fitts explained the work the association is doing in listing and indexing all literature relating to the art, and he urged members who desired further information on their problems to communicate with Mattie Lincoln Houghten, technical librarian of the association, 4800 Forbes St., Pittsburgh, Pa., as Mrs. Houghten will be glad to aid them in their search for literature on subjects pertaining to research, codification, standardization, or improvement of practice in the field of thermal engineering, with special reference to heating and ventilation.

Prof. F. B. Rowley, A. B. Algren, and J. L. Blackshaw presented a paper on surface transmission coefficients.

Effects of Air Velocities on Surface Coefficients



F. B. Rowley

Axel B. Algren

J. L. Blackshaw

To determine the effects of air velocities on surface coefficients the authors pointed out the difficulty of an exact solution because it involves the control of several variables. The surface coefficient of heat transmission is defined as the number of B.T.U. which will flow between 1 sq. ft. of the surface of the material and the surrounding air per hour per degree difference in temperature between the surface and the air.

This definition, the authors stated, is direct but before the coefficients can be determined experimentally, there are some of the factors which must be more definitely defined. They mention in particular the surface temperature, which is a rather definite quantity, and is difficult to determine experimentally, due to the effects of other temperatures. After

some experimental work, the method selected was to place the thermocouples on the surface of the material and cover them with a thin vellum paper.

The second question was where to take the air temperatures. It was decided to take them for different air velocities at distances from the surface varying from 0.05 in. up to 4 in. It was found that from 0.5 in. out these temperatures were substantially constant. Therefore, 1 in. was selected as the normal distance from the surface for which calculations of surface coefficients were made.

A third point is the air velocities and the angle at which the wind strikes the surface. In the experiments the velocities were produced parallel to the test surface and measured in this line. It was determined experimentally that at a distance of 0.5 in. from the surface, the surface coefficients have reached a constant value.

Surface coefficients were obtained for two surfaces: First, a plaster surface in which the thermocouple was embedded flush with the surface and, second, a pine surface. A further test with a pine test surface having a thermocouple embedded and using the same apparatus, and at the same maintained mean temperature, showed that there is very little difference between plaster and pine surfaces, although this cannot be taken as final on account of the variation between the mean temperatures.

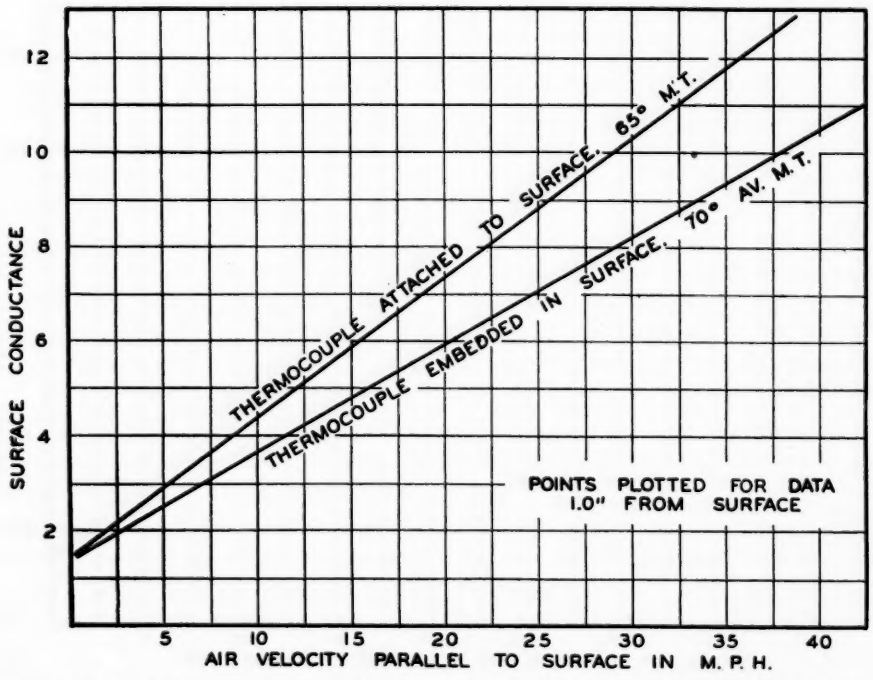
Judging from the results of the tests, there seems to be but very little difference between the coefficients obtained for the different types of surfaces. The effects of color of surrounding surfaces have been tried to some extent. Black, gray and galvanized iron all gave the same results; therefore, a dull gray was chosen for the metal surfaces surrounding the test surfaces.

It is planned to continue these experiments covering other types of surfaces and a wider range of mean temperatures and air velocities. From the data already secured, there appears to be some increase in the coefficient with an increase in mean temperatures. This difference, however, is small and the amount has not been definitely determined for all ranges of temperatures.

For practical calculations, the upper curve of the accompanying chart may reasonably be used. It will be noted that this crosses the zero air velocity line at a surface constant of 1.34, which agrees with that obtained by Willard and Lichty at the University of Illinois some years ago, and is now used in the *Guide*. The coefficient at 15 miles is, however, somewhat higher.

"Absorption of Solar Radiation in Its Relation to the Temperature, Color, Angle and Other Characteristics of the Absorbing Surface" was the title of the paper by F. C. Houghten and Carl Gutbertlet.

Paul D. Close, technical secretary of the society, presented a paper on "Preventing Condensation on Interior Building Surfaces."



Pine Test Surface. Thermocouples Attached to Surface and Embedded Flush with Surface. From Data on Surface Transmission Coefficients

Preventing Condensation on Interior Building Surfaces

Paul D. Close

A feature of the paper by Mr. Close was a chart for ascertaining the thickness of insulation required to prevent condensation when the relative humidity, the inside and outside temperatures, the transmission coefficient of wall or roof, and the conductivity of the insulation are all considered as variables. The surface coefficient was assumed to be a constant for still air with a value of 1.34 B.T.U. per hr. per sq. ft. per degree F. In using this chart, Mr. Close gave the following procedure:

1. Locate the dry-bulb temperature t of the air near the ceiling on scale A, and pass horizontally to the proper relative humidity curve, indicated on scale B.

2. From this point pass vertically downward.

3. Locate the difference between the temperature of the air at the ceiling and the lowest outside temperature on scale D, and draw a line horizontally until it intersects line 2. (The vertical line drawn as per paragraph 2.)

4. From the intersection of lines 2 and 3 draw a line to the point P in the lower left-hand corner of the chart.

5. From the intersection of line 4 and line AB, draw a line horizontally until it intersects the diagonal line corresponding to the heat transmission coefficient of the uninsulated roof shown on scale F. (See Chapter I, A.S.H.V.E. *Guide*, 1929.)

6. From the intersection found as per paragraph 5, draw a line vertically downward.

7. Locate the conductivity of the insulation to be used (expressed in B.T.U. per hour per square foot per degree F.) on scale G and draw a line to point Q.

8. From the intersection of lines 6 and 7, draw a line horizontally to

the left, and the correct thickness of insulation to use will be indicated on scale *H*.

Although Mr. Close's chart is intended primarily for roofs, it can be used for walls by taking the dry-bulb temperature and the corresponding relative humidity of the air near the walls at the point which will necessitate the maximum heat resistance to prevent condensation, instead of using the temperature and humidity near the ceiling.

If the insulation is installed in such a manner as to alter the number of air spaces in the construction, then the total heat resistance required should be determined from scale *E* from which the heat resistance of the uninsulated wall should be subtracted to ascertain the resistance to be added to prevent condensation.

In this way, any increase or decrease in the number of air spaces can be taken into consideration by adding or subtracting the resistance of the air spaces to or from the total resist-

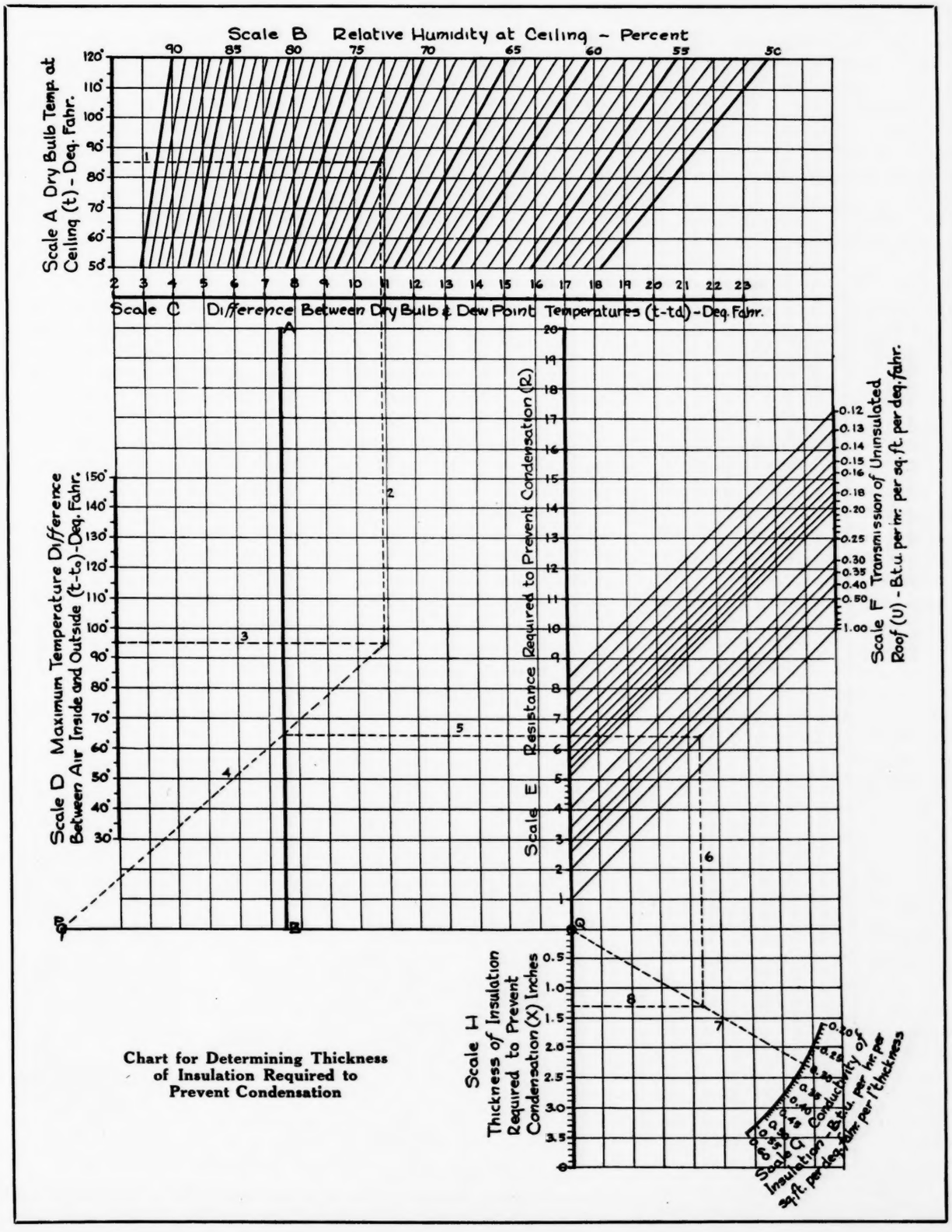

Scale B Relative Humidity at Ceiling - Percent
Scale A Dry Bulb Temp. at Ceiling (t) - Deg. Fahr.
Scale C Difference Between Dry Bulb & Dew Point Temperatures (t-td) - Deg. Fahr.
Scale D Maximum Temperature Difference Between Air Inside and Outside (t-to) - Deg. Fahr.
Scale E Resistance Required to Prevent Condensation (R)
Scale F Transmission of Uninsulated Roof (U) - B.t.u. per hr. per sq. ft. per deg. fahr.
Scale H Thickness of Insulation Required to Prevent Condensation (X) Inches
Scale G Conductivity of Insulation - B.t.u. per hr. per sq. ft. per deg. Fahr. per 1" thickness

Chart for Determining Thickness of Insulation Required to Prevent Condensation

ance to be added by the insulation itself. The thickness of the insulation can then readily be determined if its conductivity is known.

Example: Determine the thickness of insulation required to prevent ceiling condensation for the following conditions:

Dry bulb temperature near ceiling, 85° F.
Relative humidity, 70%.
Lowest outside temperature, —10° F.
Construction of Uninsulated Roof, 1 in. yellow pine sheathing and built-up roofing.
Coefficient of transmission of roof, 0.485.
Conductivity of insulation to be used, 0.30.

The solution of this problem is indicated on the chart by the dotted line.

1. Locate the inside dry-bulb temperature of 85° on scale *A*, and draw a line horizontally to the 70% relative humidity curve, indicated on scale *B*.

2. Draw line 2 vertically downward from the intersection located as per paragraph 1.

3. Locate on scale *D* the temperature difference of 95° between the ceiling temperature of 85° and the lowest outside temperature of —10° and draw a line horizontally until it intersects with line 2.

4. From the point of intersection of lines 2 and 3, draw a line to the point *P*.

5. From the intersection of lines 4 and *AB*, draw a line horizontally until it intersects with the diagonal line corresponding to a coefficient of transmission of the roof of 0.485, located on scale *F*.

6. From the intersection found as per paragraph 5, draw line 6 vertically downward.

7. Locate the conductivity of 0.30 B.T.U. per hr. per sq. ft. per deg. F. of the insulation on scale *G* and draw a line to point *Q*.

8. From the intersection of lines 6 and 7, draw a line horizontally to scale *H*, on which the thickness of insulation of this conductivity is indicated, which is 1.3 in. The nearest commercial thickness above 1.3 in., of course, would be selected.

One of the interesting points made by the author was that as the relative humidity increases beyond a certain point, the thickness of insulation increases very rapidly and a practical limit is reached to the use of insulation. However, humidities of 90% or higher are seldom encountered in any manufacturing establishment. Another point was that, although it would seem from a theoretical standpoint that the most effective results are obtained by applying insulation to the interior surfaces of a wall or roof, there are other factors of perhaps even greater importance, which make it advisable to apply the insulation as far from the interior surface of the wall or roof as possible. One factor is vapor protection to the insulation, for no insulation will function satisfactorily if it is not properly vaporproofed.

Bituminous emulsions, paints as well as cement plasters, have been used to protect insulations applied to the interior surfaces of walls and roofs, but in most cases these have been found wanting. Sheet metal will provide a vapor-tight seal if the joints are properly soldered. A satisfactory method of water-proofing a wall or a roof is by means of the membrane system, consisting of alternate layers of saturated roofing felt and bitumen applied between the warm humid air of the building and the insulation.

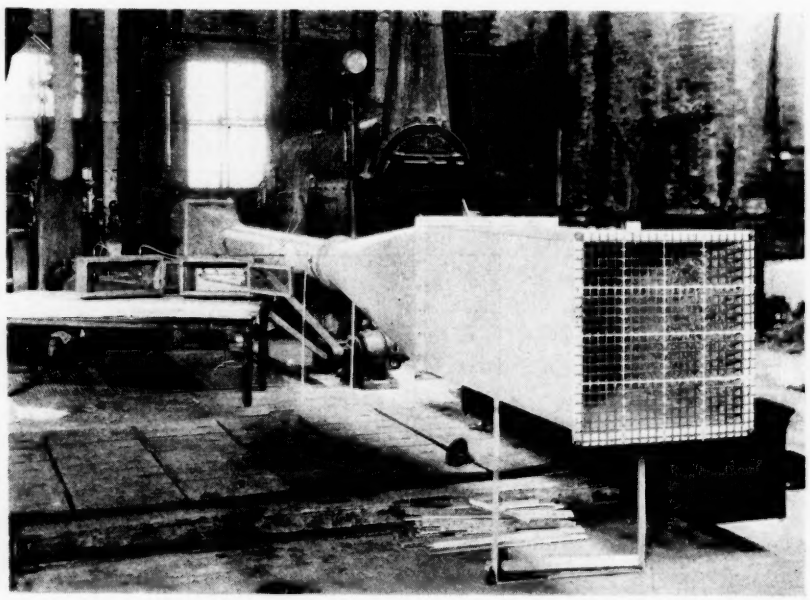
Mr. Close presented another chart in the form of a window condensation chart, for use in determining the number of panes of glass required to prevent condensation for certain temperature and humidity conditions, or for determining the outside temperature at which condensation will take place on the inside surface of single, double or triple glass for the humidity and temperature conditions involved. This chart assumes still air on the inside glass surface and a wind exposure of 15 miles per hr. on the outside glass surface, using an overall transmission coefficient for glass as of 1.13 for single glass, 0.45 for double glass and 0.281 for triple glass and a still air coefficient for glass of 1.50 B.T.U. per hr.

Mr. Close made the observation that condensation on windows is most readily prevented by using multiple panes of glass with air spaces between, but the heat resistance provided by each air space is relatively small compared with most insulations, so that usually several air spaces are required entirely to prevent condensation under severe conditions.

Wednesday Afternoon, January 29

At the opening of the Wednesday afternoon session D. E. French, chairman of the Committee for Testing and Rating of Steam Unit Heaters, presented the code on which the committee has been working. This code providing for a standard method had been adopted, with one amendment, by the Industrial Unit Heater Association at a session Tuesday. The amendment was that the check test recommended by the committee should be mandatory in the code.

The code, which is concerned only with heaters using steam as a heating medium, was prepared by a joint committee of the Industrial Unit Heater Association and the society. It provides that the rating shall in-



View Showing Original Set-Up of Apparatus for Measuring Flow of Air Through Grilles in Tests by Professor Davies

clude the following: R.P.M. of fan at full load speed; heat output in B.T.U. per hour; at least one rating showing the air delivered in cubic feet per minute of standard air; brake horsepower at standard rating and final temperature. The rating shall state the steam pressure and also the air temperature at which the C.F.M. value is taken. A tolerance of 2¼% is allowable.

Tests to determine the B.T.U. from measurement of condensation by weight and the C.F.M. from condensation and temperature rise, together with an accurate means for correcting these quantities, as obtained under test conditions, to any other condition of entering air temperature or steam pressure, are prescribed in the code.

It also prescribes that the heater being tested shall discharge into a receiving chamber where the air is thoroughly mixed in order that its true average temperature may be determined. The conditions within this chamber are to be controlled in such a way that the heater delivers the same capacity as when under normal conditions of free delivery.

Addenda to the code include recommendations for the construction and use of the equipment prescribed by the code, discussed in some detail, and a discussion of the refinements by which the test procedure can be elaborated by those interested in a high degree of accuracy.

A lengthy discussion followed during which it was stated in one comment that there was a straight-line logarithmic relation between the unit heat transfer coefficient and the volume or velocity of the air passing.

There was some discussion relative to referring the code back to the committee until further tests could be made. Members of the committee brought out forcibly that no code as adopted remained unrevised and that changes could be made at any time. The code was unanimously adopted.

Those who attended the afternoon session learned that the anemometer after all is a fairly accurate instrument and if the proper procedure is followed consistent results can be expected. This was brought out in the paper on the "Measurement of the Flow of Air Through Registers and Grilles," by Prof. Lynn E. Davies, of Armour Institute of Technology.

Flow of Air Through Registers and Grilles

Lynn E. Davies

As is well known, doubt has long existed as to the proper or most accurate method of measuring the flow of air through grilles or registers. In an effort to shed light on the question research has been conducted at the Armour Institute of Technology, in cooperation with the Research Laboratory of the A.S.H.V.E. and the Ventilating Contractors Employers Association of Chicago. The present paper embodies the results of this research.

The object of the research was to provide a simple field test, one that is applicable to the ordinary ventilating system already installed. Hence, only two types of instruments needed to be considered, the Pitot tube and the anemometer.

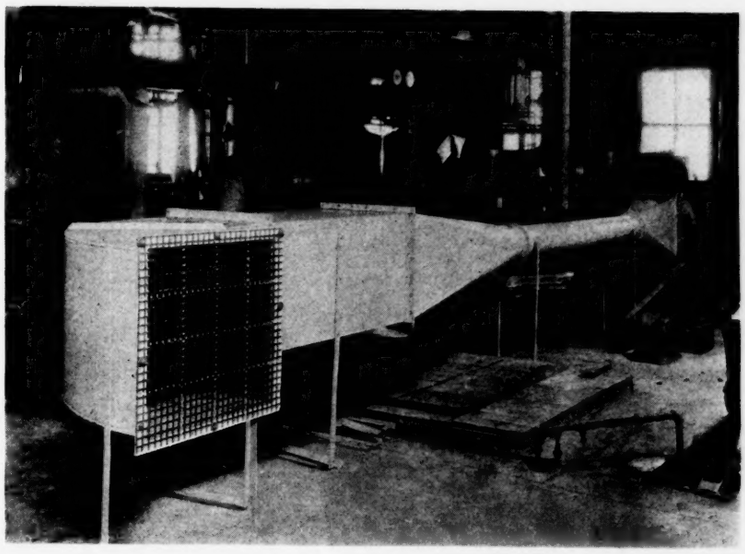
The nature of the air flow coming from a grille, the author stated, is such that no accuracy can be expected from use of the Pitot tube. Furthermore, the velocities encountered are usually so low that it would necessitate the use of a gauge several times more accurate than the usual type of portable instrument. Such sensitive gauges are only practical for use in laboratories. It is necessary, therefore, to use the anemometer and the problem resolves itself into one of how to use this instrument and how properly to interpret its indications.

In making the test, the surface of each grille was marked off into a number of equal rectangular areas. During each run two readings were taken with the anemometer opposite the center of each small area. One of these readings was taken with the anemometer held in contact with the surface of the grille, the other with the instrument held 3 in. away. In each case the average of the sixteen readings obtained was corrected for instrument error and then multiplied by the gross area of the grille. Similarly each corrected average velocity was multiplied by the net free area. This resulted in five values for the air flow for each run, namely:

1. Anemometer reading in contact multiplied by gross area.
2. Anemometer reading in contact multiplied by net free area.
3. Anemometer reading 3 in. away multiplied by gross area.
4. Anemometer reading 3 in. away multiplied by net free area.
5. Quantity as measured by Pitot tubes.

By comparing the results obtained by the first four calculations with the result of the Pitot tube traverse, it is possible to determine which method, if any, is the correct one for calculating the volume of air from the indicated velocities shown by the anemometer.

When the instrument is held in contact with the grille, the face of



View Showing Elbow and Grille Connected to Straight Duct

the anemometer, it was found, is not subjected to a uniform flow of air over its entire area, but instead is exposed to a group of small jets divided by regions of dead low velocity or turbulent air. The portion of the area touched by the jets is probably approximately equal to the percentage of free area of the grille.

To maintain that Method 1 is correct is to claim, in effect, that an anemometer exposed to a variable velocity across its face, indicates the true average velocity. This may appear to be a perfectly reasonable assumption, but those who are familiar with the action of anemometers know that they always indicate a value nearer to the maximum than to the minimum and, therefore, somewhat higher than the average. The results obtained by this method, therefore, will probably be too high.

Method 2 would be correct if the anemometer indicated the maximum velocity striking the blades. This is not the case because in the regions of low velocities the vanes act as a propeller, drawing the air forward, and this action naturally imposes a load on them which reduces their speed of rotation. This method, therefore, may be expected to give results which are too small.

Method 3 appears to be more nearly correct than the others if the instrument is held sufficiently far away to have the individual jets blend together into a solid stream of uniform velocity. The results indicate that 3 in. is not sufficient to accomplish this objective.

Method 4 does not require consideration, since it is apparent that a value lower than with Method 2 is obtained, which is too small.

When the anemometer was held in contact with the grille and the velocity indicated was multiplied by the gross area, the results obtained were from 19% to 26% too high. When these readings were multiplied by the net free area of the grille, the results were from 13% to 40% too low. Special attention was directed to these results, as this method has been used more than any of the others.

Readings taken 3 in. from the face of the grille disclosed errors ranging from + 10% to + 36% when the gross area was used, and from —27½% to —44% when the net area was used.

These results, stated Mr. Davies, show plainly the urgent need for more accurate formulae than any heretofore used. Since for corresponding runs the percentage of error in the two cases was approximately equal, Mr. Davies suggested the use of a new formula: C. F. M. =

$$\frac{V(A+a)}{2} \text{ or } \frac{VA(1+p)}{2} \quad (1)$$

in which

V = corrected average anemometer reading taken in contact with grille, in feet per minute.

A = gross area of grille, square feet.

a = net free area of grille, square feet.

p = percentage of free area of grille expressed as a decimal.

Applying this formula gave results in which the maximum error was 5% and this could have been still further reduced had a coefficient of 0.98 been introduced into the formula. In view of the fact that the work so far has been confined to a limited number of types of grilles, it appears desirable that a coefficient C be introduced into the formula to provide for a variation in results which may occur when different types of grilles are investigated. The formula will then become

$$\text{C. F. M.} = \frac{CV\ (A+a)}{2} \text{ or } \frac{CVA\ (1+p)}{2} \quad (2)$$

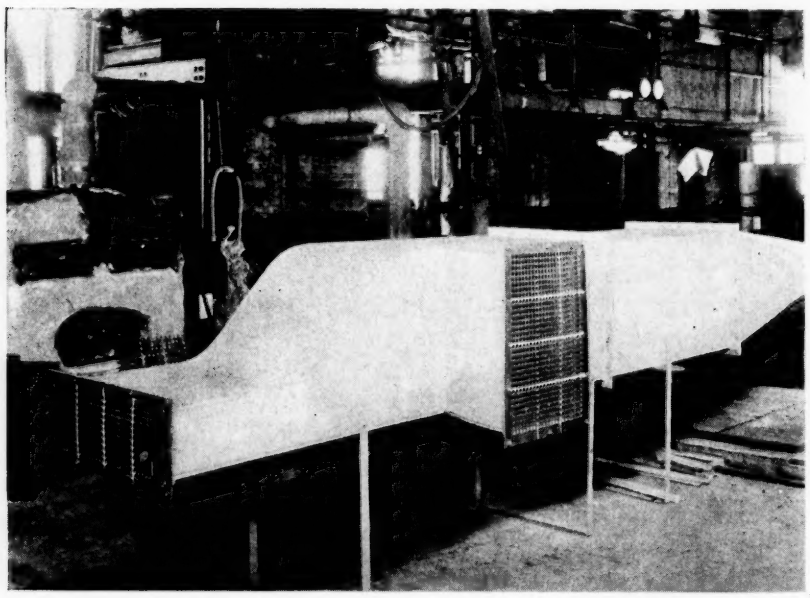
It is the opinion of the author that the use of a constant value of 1.00 or 0.98 for C will introduce less error than that encountered from other sources.

The second section of Mr. Davies' paper was devoted to the performance of the anemometer on exhaust registers. The same apparatus was used except that the test duct was connected to the suction side of the fan and all of the work was done with the straight duct. All of the anemometer traverses were made in contact with the grille. In this test, when the anemometer readings were multiplied by the net free area of the grille, the error amounted to from 7.3% to 51.6%, a much wider variation than that obtained with the supply grilles. Even when the new formula was applied the results showed great variation.

Since the value of C does not seem to follow any rational law as to type of grille, it appears that the only alternative is to take practically an average of the readings.

When the indicated velocities through the exhaust register were multiplied by the gross area of the grille, the amount of variation was found to be much less than with supply grilles, especially if values for equal velocities are compared.

The author presented a formula in which



View Showing Branched Duct Connected to Straight Duct

C. F. M. = K V A

V equals indicated velocity in feet per minute.

A equals gross area in square feet.

K equals a constant ranging from 0.738 to 0.851. If a constant value of 0.8 is used for K, the maximum error will be 7½%.

In conclusion, Mr. Davies referred to the question most frequently asked regarding the feasibility of making a traverse by moving the instrument over the face of the grille, thus securing a single reading, instead of a number of spot readings. Check readings were frequently made in this manner throughout these tests and quite satisfactory results were secured. The greatest error is likely to result when there is a wide variation in velocity across the face of the grille.

L. S. O'Bannon

Prof. L. S. O'Bannon, of the University of Kentucky, described a "Method of Testing Unit Heaters Suitable for Field Use."

MORNING SESSION, JANUARY 30

L. A. Harding, chairman of the Continuing Committee on the Rating and Testing of Low-Pressure Steam Heating Boilers, presented the report of that committee and explained it in detail. The opinion of the committee was that a multi-rating code would be most advantageous to an engineering society although recognizing that a single-rating had considerable merit for commercial reasons.

At the request of the Steel Heating Boiler Institute, the committee included in its report a discussion of the dimensional code proposed by the institute. The rating for steel boilers, proposed by this organization, is based entirely on physical characteristics, such as grate area and heating surface. Mr. Harding pointed out that such a rating did not take into account such an important factor as the heat value of the fuel.

Thornton Lewis, following the presentation of the report, suggested that the paper by C. E. Bronson, "The Rating of Heating Boilers by Their Physical Characteristics," be read before discussion was opened on the boiler code.

Rating of the Heating Boilers by Their Physical Characteristics

As Mr. Bronson stated, this paper is presented in explanation of the code for the rating of low-pressure heating boilers adopted by the members of the Steel Heating Boiler Institute. The code, which was attached to the paper, was published in HEATING AND VENTILATING for January. Rating boilers by their physical characteristics is offered as an alternative to the method of determining ratings by means of test characteristics. The proposed method, stated Mr. Bronson, has the advantage of representing the size of the boiler by a single number, which has a certain and definite relation, not only to the load for which the boiler is selected, but also to the operating characteristics of the boiler itself. This single number rating is easily determined from measurable proportions of the boiler and obviates the necessity for a long and extensive program of tests.

Mr. Bronson made the point that the rating should be a single number, and should have a definite relation to the load imposed on the boiler. He stated further that if a single number rating is assigned to a boiler, it must be an indication of capacity. The capacity of a boiler is dependent upon two main variables:

1. Rate of fuel burning.
2. Ability to absorb heat.

The rate at which fuel may be burned is dependent upon the area of the grate, the kind of fuel and the available draft. If the draft required or the chimney size is given for the ordinary grades of fuel used, it would be possible to assign a value for the rated capacity of a boiler based on the grate area. This considers only hand-fired solid-fuel-burning boilers.

Ability to absorb heat is dependent upon the amount of heating surface interposed between the grate and the chimney. Therefore, it is logical to assign a uniform value of capacity based on total heating surface. Then it is possible to assign a capacity value or rating to a heating boiler based on:

1. Heating surface.
2. Grate area.

In the proposed code rating is defined as the heating surface multiplied by a factor of 14. There is a precedent in the choice of such a factor. Ratings for power boilers have been made for years on the basis of 10 sq. ft. of heating surface per boiler horsepower. A boiler horse-power is defined as the evaporation of 34.5 lbs. of water per hr., from and at 212°F. This is equal to the delivery of 34.5 × 971.7 (latent heat at 212°F.) or 33,524 B.T.U. per hr. Expressed in square feet of radiation, a boiler horse-power is equal to

$$\frac{33{,}524}{240}$$ or 139.7, practically 140.

With 10 sq. ft. of heating surface per boiler horse-power of rating, the ratio of rating surface becomes 14, the figure selected.

Practice in former years in selecting boilers based on boiler horsepower was to allow one boiler horsepower for every 100 sq. ft. of radiation, leaving a margin of 40% to take care of losses in mains, risers and returns. This is equivalent to making the boiler rating ten times the heating surface. Since 40% is rarely required to care for losses due to mains, etc., present boiler ratings have been assigned on ratios varying from ten to twelve times the heating surface, the manufacturer recommending that losses due to mains, risers and returns need not be figured, but that the boiler be selected on the basis of installed radiation.

Other manufacturers have assigned still higher ratings based on values as high as fourteen times the heating surface and recommending that the entire normal load be used in selecting the proper size of boiler. A uniform method is desirable, consequently the proposed code recommends in placing the rating at fourteen times the heating surface, that the total normal load be used in selection. By this method the boiler rating is equal to the boiler output required for the normal heat demand.

Mr. Bronson presented a chart showing how present boiler ratings are based on heating surface and how these ratings average fourteen times the heating surface. In another chart he indicated the relation between grate area and ratings for the same boiler.

Formulae in the code for minimum grate area, he stated, were developed after due consideration had been given to the various factors involved. In general, small boilers installed in residences are connected to chimneys of 30 or 40 ft. in height. The draft available from such chimneys is comparatively small in value. Long periods of time without attention to the fire are desirable. In hand-fired boilers, the grate must be utilized partly as fuel-storage space, consequently the rates of combustion for small boilers must be kept low in value. Larger boilers have higher chimneys, are fired more frequently and therefore may be allowed higher combustion rates.

While more grate area should be allowed for small boilers than for large boilers, it seemed that the rating of boilers of exceptional proportions increased approximately according to the square of the grate area. The formulae cover two ranges of rating values, as it was considered easier to use even, instead of fractional exponents. Resulting grate areas calculated by the formulae were also checked with the allowances made by other authorities and were found to agree quite closely. ("Net Loads for Heating Boilers," issued by the H. & P. C. N. A., April 29, 1929.)

There is no priming limitation mentioned in this code. It always has been tacitly understood that a boiler built for producing steam means one capable of furnishing steam only and not a mixture of steam and water. A limitation of moisture content of 2% or 3% would be acceptable and reasonable. Since a boiler which would furnish more than a reasonable amount of moisture with the steam could be no longer classed as a steam boiler, it is believed unnecessary to comment further on this point.

Rating, according to this code, is made equal to the estimated design load or normal load and is the recommended basis of selection. The three items considered as making up the estimated design load are the same as items A, B and C outlined in Section V of the A. S. H. V. E. Code of Minimum Requirements for the Heating and Ventilation of Buildings.

No reference has been made to starting load or the load imposed on the boiler due to warming up cold mains and radiation. The starting load is considered an overload on the boiler above its rating and is taken care of by the boiler manufacturer in the specification of chimney for each boiler.

Under present methods of selecting steel boilers and with chimneys as recommended, the maximum output exceeds the total requirements as specified in the Code of Minimum Requirements. In other words, there is greater margin allowed between maximum capacity developed and normal load. Maximum capacity is dependent primarily on available draft and efficiency of the heating surface.

The constants used in the code for the determination of rating are admittedly arbitrary. Yet these constants have been selected with due regard to controlling factors. Furthermore, the boiler manufacturers themselves have expressed willingness to be governed by these values with the idea of securing uniformity in the method of rating. The individuality of any boiler manufacturer is not submerged since the question of capacity only is covered and the question of efficiency is left open.

No attempt has been made to evaluate heating surface. Otherwise this code might have the aspect of a construction code rather than a sizing code. Nevertheless, the requirement of a total heating surface of a certain value will insure a certain minimum efficiency. Efficiencies of a higher degree will be governed entirely by the ingenuity of the manufacturer in providing not only for high furnace efficiency by means of insuring thorough mixing and burning of the gases before they leave the furnace, but also by providing sufficient water volume for the heating surface, thereby preventing steam blocking, with consequent rapid decrease in heat transmission as the rate of heat transfer increases.

In order to give a clear conception of the code requirements, Mr. Bronson presented a table of the minimum heating surface and the grate area for boilers of various ratings. (This table appeared in HEATING AND VENTILATING for January.) For each rating, values of combustion rate, fuel charge and firing period are given for the condition when the boiler output is equal to the rating.

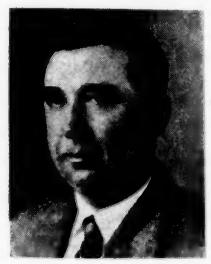
Discussion on the code was participated in by Willis H. Carrier, C. W. Obert, Raymond Newcomb, Harry M. Hart and others. Mr. Carrier said that one of the principal objections to the dimensional code was that it did not provide for future developments in boiler design, whereas the performance code proposed by Mr. Harding and his committee could be used regardless of design. Mr. Obert stated that some combination of the performance code and the dimensional code might prove desirable.

Mr. Hart objected to the proposed code only on the ground that it did not provide for a factor of safety, which he suggested be made 40%.

A resolution was offered that the code be formally adopted by the society. Prof. F. B. Rowley proposed an amendment to the resolution providing for a mail ballot. The amendment carried and the code will be referred to the members for vote by letter.

Airation Study of Garages

L. W. Leonhard



W. C. Randall

After noting that the problem of heating rather than ventilation is the main reason for the acute conditions that prevail at times in garages, due to the presence of carbon monoxide, the authors describe the investigation they made to determine the use of airation or natural ventilation as a means of diluting the carbon monoxide concentration of the air in various types of garages.

The research included a multi-story ramp, auto service garage, alley repair shop and the private home garage. It consisted of a study of the airation, the carbon monoxide concentration of the air within the buildings, and at times the effect of carbon monoxide poisoning upon the employees.

Samples of the air within the building were taken in at least six localities on each floor, at the floor level, and, in the later surveys, also at a level about 5 ft. above the floor. All samples were taken by purging the original air from 250 cc. bottles by means of a rubber aspirator bulb with attached scrubber, and were analyzed by the Pyrotannic Acid Method for quantitative determination of carbon monoxide in air.

It was brought out in the investigation that:

Multi-story Ramp Garage

Sufficient air can be furnished through window openings, as natural ventilation, to keep the carbon monoxide concentration below a harmful or even disagreeable degree.

Higher concentrations of carbon monoxide were found to occur on extremely cold days when it became necessary to close all or all but a few windows in order that comfortable inside temperatures might be maintained.

Tests showed that the carbon monoxide content of the air in this type of garage is practically the same at the floor level as it is 5 ft. above the floor. This is due to the fact that a motor is seldom running unless the car is in motion and the gas is well diffused by the action of cars going up and down the ramps.

Auto Service Garage

Practically no trouble would be experienced from carbon monoxide poisoning in the garages studied if some reasonable percentage of available ventilation areas were utilized.

Where unit heaters are employed, the carbon monoxide is more thoroughly diffused than where direct radiation is used.

In the garages studied, sufficient heat was not supplied in cold weather to warm the necessary volume of air to a comfortable temperature.

Alley Repair Shops

Carbon monoxide poisoning is not a serious problem in these shops, since motors are seldom operated within the building unless the doors are open.

Private Home Garages

A four-cylinder motor operating at a racing speed in a two-car garage with doors and windows closed would produce a concentration of carbon monoxide which would probably cause death to anyone exposed to it for 10 min. or more.

AFTERNOON SESSION, JANUARY 30

Elmer S. Smith

"Pipe Sizes for Hot Water Heating Systems" was the subject of a paper by Elmer Smith and Prof. F. E. Giesecke. This contained numerous tabulations for pipe sizing for water systems as determined from tests at the Texas A. & M. College.

L. J. Fowler, of London, England, presented his paper on "Panel Warming" as practiced in England.

Panel Warming

In his paper, Mr. Fowler discussed the panel method of heating developed by Richard Crittall & Company, Ltd., of London. This system is familiar to readers of HEATING AND VENTILATING through a number of articles on the subject, including one published in August, 1929, illustrating and describing the installation in the Imperial Chemical House in London.

In explaining the principles of panel heating, Mr. Fowler pointed out that if the walls and ceiling of a room are maintained at about 75° the mean radiation losses from the human body are almost nullified, and although the air temperature may be as low as 50°, bodily heat, lost only by convection, is easily balanced by the normal metabolism, so that no discomfort is felt. These conditions pertain only to still air, for in drafts convection increases, and rises in temperature of 3° and 6° are necessary to counteract air movement of 160 and 200 f.p.m., respectively.

Mr. Fowler told how Prof. A. H. Barker, over 20 years ago, conceived the idea of a strictly radiating surface of comparatively large surface and comparatively low temperature. From this developed the idea of imbedding pipe coils in the walls and ceilings of a building and of operating this radiation at a comparatively low temperature. At times, panel radiation is maintained as low as 75°.

The panels generally consist of coils of steel pipe through which water flows and the inevitable development of the principle to electrical power has eminently been successful. The pipes, usually of ½ to ¾ in. diameter, run parallel to each other at 4 to 6 in. centers and are imbedded in concrete in the underside of the ceiling of the room to be heated. The surface of the concrete is then plastered, rendering the panel invisible. Heat is conducted from the pipes to the plaster face and is then emitted in radiant form.

As generally applied, the panel system is a low-pressure hot water system, the circulation being either accelerated or by gravity in smaller installations.

Standard arrangements have been developed for incorporation of coils behind various types of walls, floors or ceilings by means of special precast plaster slabs which contain the coils, and which are finished in conformity with the decorations of the room. Other types of panel can be applied to surfaces of walls and ceilings of new or existing buildings. The pipes are attached either to cast iron or steel plates and the heat from the pipes is conducted through the plate.

In addition to those designed for steam and water, electric panels have been developed, formed of light asbestos sheets, faced with cork, on which is placed a layer of plaster composition about ¼-in. thick, containing a grid work of specially-insulated wire element. This makes a panel of a total thickness of about 1½ in. In existing structures, a number of standard units, connected to form a complete panel of suitable dimensions, are finished with a neat beading and are screwed to the surface of ceilings or walls. In a new structure or one where cutting away does not involve serious difficulties, the panels can be sunk flush with the finished ceiling or wall face.

A compromise between the hot water and the electric panel is in the form of heating elements encased in sheaths of glass which are placed inside steel tubes, the space between the two being filled in with a plaster material to permit ready conduction from one to the other. The tubes are cast into ceilings or walls, or at times into floors. The positions that they occupy and the results obtained from them are similar to those of hot water panels.

The author included some operat-

ing cost figures which in one case indicated a cost one-third as much as that for a gas fire in an adjoining building. With regard to the cost of installation, it was stated that this exceeds by only a small margin that of an exposed radiator system, if the expense of enclosing and decorating the exposed portions of the radiator systems is considered. The complete invisibility of the radiating surface and of the risers is cited as an important feature from an architectural standpoint.

With regard to expansion and corrosion, the author stated that with a normal working temperature of 120°, the stresses set up in the concrete are not sufficient to cause failure or cracking. Danger from corrosion may practically be prevented by avoiding the use of any oxy-chloride compounds.

A further development of fundamental importance mentioned by Mr. Fowler, is the use of panel systems for cooling during summer months. Water at a temperature of 40° to 50°F. is used as the cooling medium.

A paper by F. I. Raymond and R. D. Lambert on the "Development of a Method for Heat Regulation" was presented. This paper discussed heat regulation controlled by both indoor and outside temperatures.

MORNING SESSION, January 31

At the concluding session Friday morning papers were presented on the operation of domestic fan furnace heating systems by Professors A. C. Willard and A. P. Kratz; on "Air Conditioning of the Halls of Congress," by L. L. Lewis and A. E. Stacey, Jr., and "Tests of Disc and Propeller Fans," by A. I. Brown.

Friction Losses and Observed Static Pressures in a Domestic Fan Furnace Heating System

Interesting results of experimental work carried on at the Research Residence of the National Warm Air Heating Association were reported by Professors Willard and Kratz, on friction losses and observed static pressures in a domestic fan furnace heating system. As was pointed out by the authors, the rating of a fan under the usual still air conditions does not apply when the fan is installed within a duct in a moving air stream of variable velocity and of a volume which is often equal to, or even in excess of, the fan capacity in still air.

As a result of the failure to take account of the peculiar conditions surrounding the installations of fans in domestic furnace heating systems, the following possibilities or situations may arise:

1. With a well-designed gravity circulation system and the usual commercial fan as applied today, the natural circulation of the furnace may practically submerge the fan and the fan may become a drag on the system. This is almost certain to occur at high combustion rates, and with small fans.

2. With any system designed for gravity circulation, the fan will almost invariably unbalance the previous gravity operation of the system. This means, usually, more air to first-floor rooms or to short, direct runs.

3. Favored rooms will immediately overheat, unless the air temperature at the registers to these rooms is reduced.

4. Since both the fan and the natural circulation always take place simultaneously when the furnace is under heat, the resistance which the fan has to overcome is an extremely variable quantity, which may actually range from a positive to a negative value.

5. The propeller type of fan placed in the return duct develops a greater air-handling capacity with the bypass dampers closed than with them open. In either case, the fan suffers a material reduction in its free-air-handling capacity. The net aspirating effect of such a fan in a large return duct, with the dampers open, is of negative value since any induced flow which may occur is much more than counterbalanced by the eddy currents and short circuiting which can and does occur when there are no bypass dampers. Such fans, therefore, should be installed, as is generally customary, with automatic bypass dampers when placed in large return-air ducts.

6. Noise of a more or less noticeable character is almost certain to be transmitted to the occupied rooms of the residence.

The authors took pains to point out that a fan of proper size may have beneficial effect on residence heating. For example, provided the furnace is hot and the fire is maintained in normal condition, the starting of the fan will almost instantly increase the heating capacity of the furnace and its efficiency. The fan, it is stated, will do little good unless there is a residual heat in the furnace itself and an active fire is maintained. Fans should not be depended upon to correct improperly-designed or poorly-installed gravity circulating furnace heating systems. If the system is already out of balance, the fan may merely aggravate the situation unless the distributing system is readjusted to favor the unfortunate rooms. A properly-designed and correctly-installed gravity circulating system, the authors add, does not need a fan.

Briefly, the test indicated that the friction loss is small in a well-designed gravity furnace heating system and that the observed heads are very low even with a cold furnace. Furthermore, when the furnace is under heat, these heads become progressively smaller and assume negative values at the higher register air temperatures.

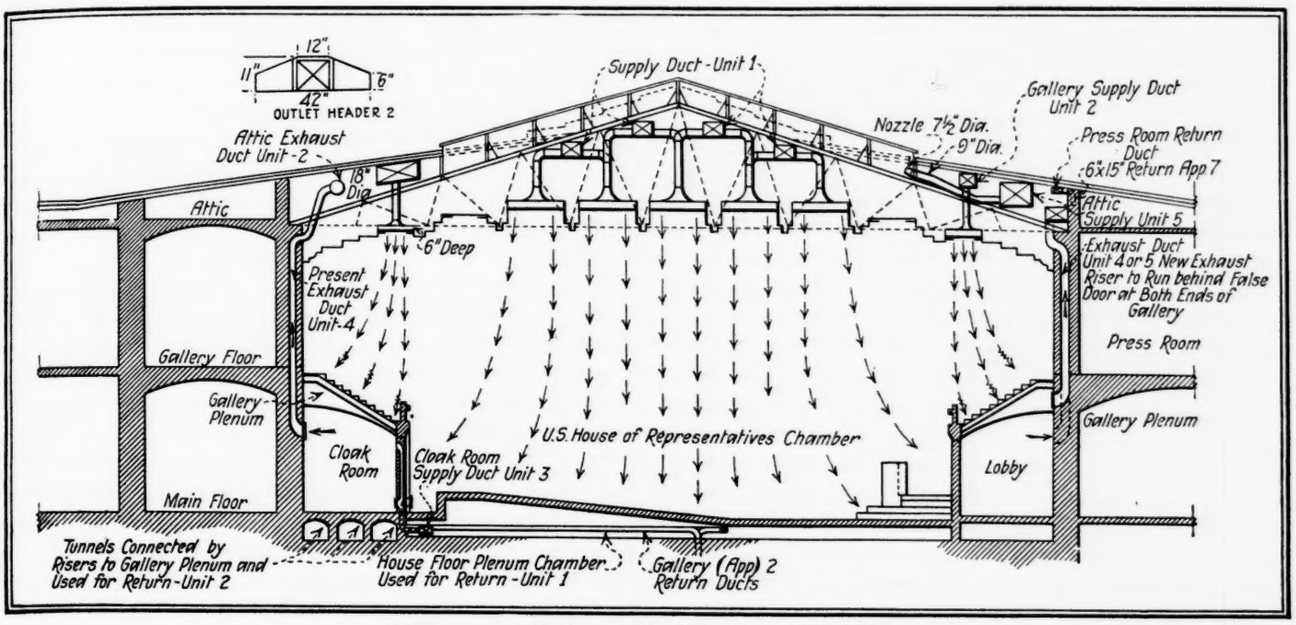
Air Conditioning the Halls of Congress

L. L. Lewis

A. E. Stacey, Jr.

In this paper the noteworthy Carrier air-conditioning installation in the Capitol in Washington was described. The scope of the work was the installation of equipment to air-condition the floor, chamber, galleries, cloak rooms and press rooms of both the Senate and the House. The systems are designed to cool the air to a temperature of 75° F., with a relative humidity of 40%. In winter the systems are capable of heating to 80° F. and coincidentally maintaining a relative humidity of 50%. As will be noted from the sectional view of the installation, it is of the downward diffusion type.

Seven systems are comprised in the



A Transverse Section of the Chamber of the House

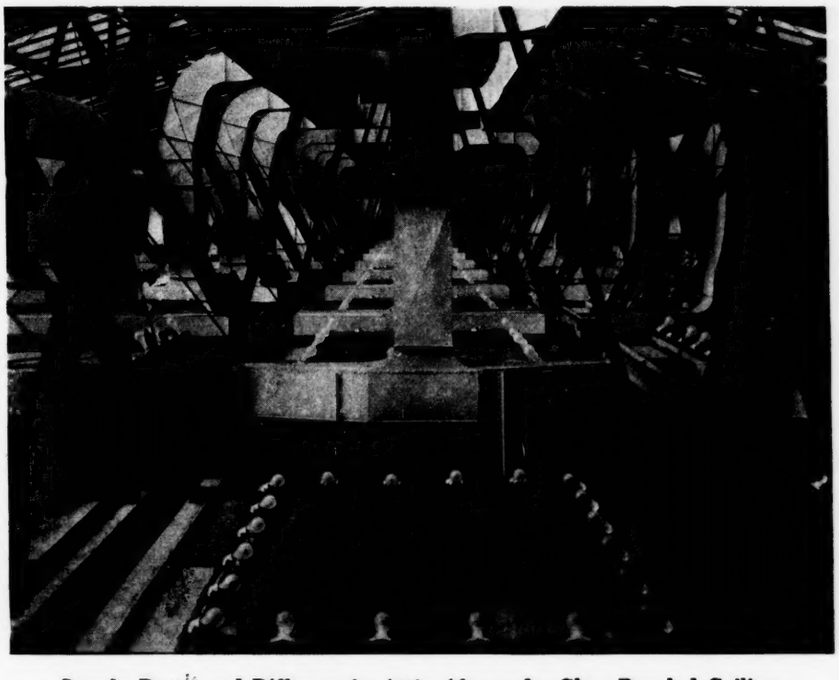
The speaker on the right faces toward the cloak rooms. Openings from the floor to the exhaust chamber beneath are not shown.

installation. Of these, five are supply systems, one serving the floor of the House, the second the galleries, the third the cloak rooms, the fourth the attic space, and the fifth the press rooms.

The problem was so to balance the supply and exhaust that an excess of air would be brought in with the great central stream descending upon the floor and expanded outward, to be exhausted through floor openings under the gallery seats. In this way, the occupants of the floor are completely isolated from those of the gallery.

A total volume of 36,000 cu. ft. per min. is supplied by the apparatus serving the floor, that is, from System 1. An equal volume is supplied by System 2, serving the galleries. Approximately half of the volume of air handled by System 1 may always be taken from out-of-doors, this coming through a tunnel terminating in a tower intake located about 500 ft. from the apparatus in the grounds at the rear of the building. A small amount of recirculating air is taken from an exhaust chamber under the floor of the House.

One of the notable features of the installation is that it was carried out without disturbing the architectural features of the ceiling. To accomplish this, it was necessary to resort to some highly ingenious expedients. For instance, many of the decorative features of the ceiling were fastened with bolts. The glass panels were framed in heavy wrought-iron and these frames could be raised sufficiently to provide space for headers to distribute the air around the edges of the panel. In solving the light and shadow problem, a multiplicity of horizontal and vertical ducts was installed, as indicated in the illustration.



Supply Ducts and Diffusers in Attic Above the Glass-Paneled Ceiling of the House

Another feature of interest was the arrangement of the air ducts which had to pass through many tortuous passages, then through heavy stone foundations and upward through existing flues to the attic space. In some cases it was necessary to cut through 8 ft. of blue stone foundation wall.

All of the air is passed through oil filters. System 2, connected to the two cloak rooms, is unique in the fact that all of the air can be delivered either at the floor or ceiling. At present, part of the air is being delivered at the floor and part at the ceiling.

Particular interest attaches to the attic supply system, which serves the

triple purpose of utilizing the air from the chamber to cool the attic space, thereby forming a barrier between outside conditions and the chamber proper. In addition, it heats the attic space, whenever necessary, to prevent the glass ceiling from cooling the upper strata of air in the chamber, while in severe weather it maintains a relative humidity and air movement underlying the glass roof, thus preventing condensation on the surface.

In order to prevent the absolute humidity in the attic from reaching a point approaching that of the chamber by leakage through the paneled ceiling, the inner surface of the roof, in winter, is swept with a current of warm, dry air to keep the surface temperature below the dew-point. In summer, the used air is taken from one of the exhaust systems, is delivered through a second set of outlets designed not to sweep the roof but to cool the lower portion of the attic, while leaving the hot strata undisturbed in the upper section.

Thus the temperature fluctuations in the attic space are greatly reduced, thereby relieving the automatic regulation of the floor and galleries, reducing the radiation losses from the attic duct work and reducing the temperature head at which air must be delivered.

Included in the refrigerating equipment is a refrigerating machine of 206 tons capacity, placed in a room near the main apparatus room. It is interesting to note that if all outside air were used, instead of partial recirculation, there would have been needed 486 tons of refrigeration to maintain the same air conditions in the chamber. The compressor of this machine is driven by an 1800 R.P.M. alternating-current variable-speed motor, connected through increasing gears.

As condensing water could not be taken from the city mains, because of an insufficient supply, and no location was available for a spray pond or cooling tower, it was necessary to install a special air cooling system consisting of a fan drawing 49,000 cu. ft. of air per min. from an interior court through an air washer and discharging it through a vertical flue rising to the roof. The exhaust from the refrigerating machine room is connected to the inlet of the same fan.

In both the condenser and the cooler of the refrigerating machine, the water passes through small tubes in a completely closed circuit. The condenser water pump, therefore, withdraws water from the tank of the condenser water cooler of this system and forces it through the condenser and back to the sprays under pressure. A single pump withdraws the used cold water from the tanks of Systems 1 and 2 and likewise pumps through the cooler to the sprays. A third pump supplies the necessary volume of cold water to the press room system in the attic. All horizontal runs of water piping are placed in trenches beneath the floor.

Annual Banquet and Dance

At the annual banquet, held in the Benjamin Franklin Hotel, Thursday evening, January 30, John D. Cassell acted as toastmaster. He introduced Cecil W. Farrar, chairman of the drive for membership, who presented the prizes to the four members of the society who secured the most members during the drive. The society also presented a banner to the Michigan Chapter which showed the largest percentage of increase in membership.

H. P. Gant paid a fine tribute to the retiring president, Thornton Lewis, in presenting him with the past-presidents' emblem. Mr. Gant said that in his opinion Mr. Lewis's work as president has been outstanding among the accomplishments of all the past presidents.

Mr. Lewis introduced L. A. Harding, the incoming president, who made a short address in which he stated that he was not unmindful of the tribute paid him and that to the best of his ability he would carry on the work as president.

Thornton Lewis told the members how the council had been promised a percentage of the gross receipts from the Heating and Ventilating Exposition by C. F. Roth, of the International Exposition Company. The council had told Mr. Roth that the society was interested in the exposition for the good of the industry and not through any idea of financial gain. The council further told Mr. Roth that if his company desired to contribute 5% of the gross receipts to the society's research fund, the society no doubt would be glad to accept. Mr. Lewis then told how the exposition had been so successful and the management so generous that it had voluntarily contributed to the fund, not 5%, but 10% of the receipts, amounting to $5000.

At the close of the addresses Mr. Lewis read a letter to the society announcing a gift of $1000, the income of which is to be used for presenting to one of the younger members of the society each year an award of some kind for outstanding meritorious work in heating, ventilating or air conditioning. The award will be made by the council. The first award will be made to some member under 30 years of age for the best technical paper on the art.

Mr. Lewis had saved a surprise for the meeting, as the letter was signed by himself. He then announced that the award would be named after Dean F. Paul Anderson, of the University of Kentucky.

Guests then indulged in dancing and an entertainment feature, "A Trip to Monte Carlo."

Part of the Convention Party in Front of Washington's Headquarters at Valley Forge

Heating and Ventilating Exposition Exceeds All Expectations

NOT even the most optimistic supporter of the First International Heating and Ventilating Exposition, which was held at the Commercial Museum in Philadelphia, January 27-31, realized the extent to which the show was destined to "go over." In spite of the fact that the exposition hall was across the Schuylkill River, a matter of nearly two miles from the headquarters of the A.S.H. V.E. in the Benjamin Franklin Hotel, the crowds flocked to the exposition from the moment of its opening, Monday noon, until its close, Friday night. Where the expected attendance was estimated at less than 10,000, the actual figures ran up to four times that number. On Wednesday and Thursday alone, over 17,000 people visited the show each day.

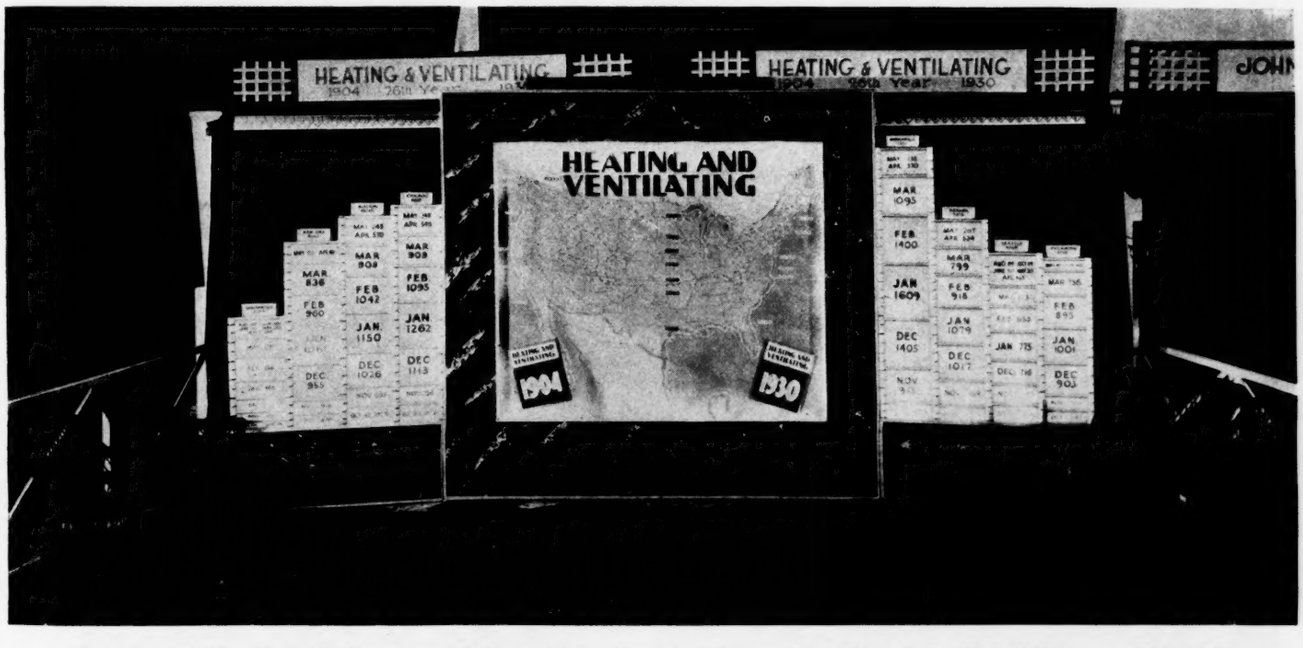
To say that the 240 exhibitors were satisfied with the exposition only faintly expresses the situation. A careful check disclosed the fact that they were more than satisfied and were practically unanimous in expressing their intention to exhibit at the next show, two years hence.

"This show," declared an oil-burner company executive, whose booth was a center of attraction, "is by far the best one at which we have exhibited, and we have 'shown' at practically all of them. We are more than satisfied with the results." Several cases were reported of the placing of important orders, on the part of foreign representatives, from Australia, Germany and Switzerland.

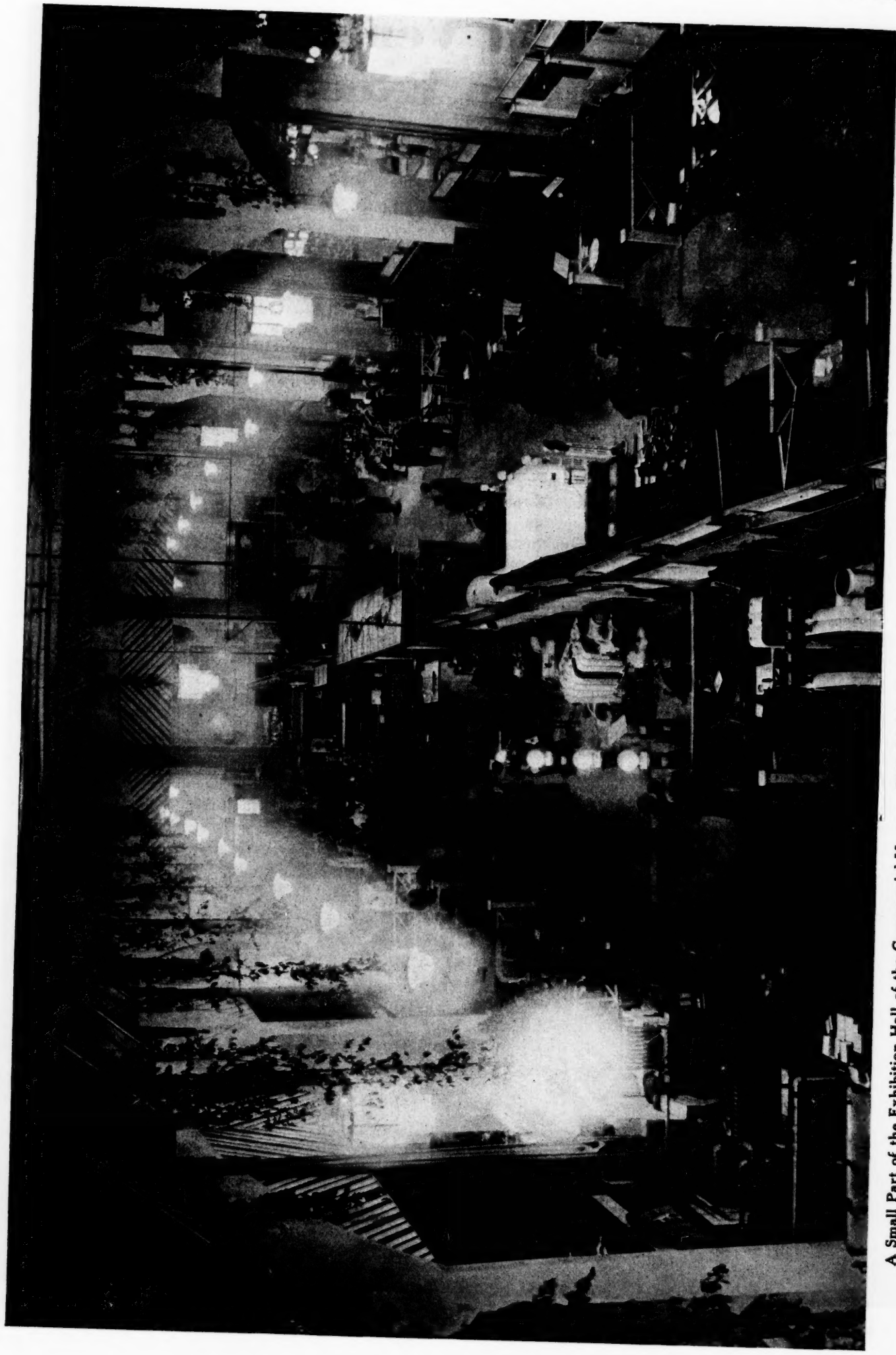
What added immensely to the success of the exposition was the fact that so many of the appliances and so much of the apparatus was shown in operation. In the oil-burner section, for instance, fully a dozen of the oil burners were operating in boilers set up for the purpose and while the stack connections were not all that could be desired, the fact that the visitors had an opportunity to see the character of the flame and note its action, added immensely to its effectiveness. It also settled for many the all-important question of noise in the combustion of oil. Although admittedly the displays were not adjusted for the most effective operation, it was a matter of comment that the burners offered little basis for complaint on that score.

Both the gas-burning exhibits and the domestic stoker displays were centers of attraction on the same ground that they were actually in operation and gave the visitors an actual demonstration of the way they "work." In every case where the old method of display through the use of transparencies had been adopted, the contrast was striking.

As was to be expected, many new products were introduced to the industry, including some unique types of light-weight copper radiation, air cooling machines operating in conjunction with unit heaters, several new makes of oil burners, new applications of zone control appliances and interesting types of home humidifying equipment, all of which will be presented in subsequent issues of HEATING AND VENTILATING. One of the most valuable features of the exposition was the opportunity afforded for cooperation on the part of manufacturers whose apparatus was supplementary to that of other manufacturers. Many important



Heating and Ventilating's Booth at the Exposition, Featuring Degree-Day Map of the United States and Monthly Heating Loads in Eight Cities



A Small Part of the Exhibition Hall of the Commercial Museum, Philadelphia, Where the First International Heating and Ventilating Exposition Was Held

hook-ups were inaugurated which will be reflected in further developments of many well known products.

What contributed as much as anything to the value of the exposition was that its promoters had caught the vision of what the heating and ventilating industry represents. This was reflected not only in the type of exhibitors, but in the character of their displays. The show was *par excellence* a commercial exposition, as distinguished from a home-building show, on one hand, and a purely industrial exhibition, on the other.

HEATING AND VENTILATING'S booth, near the entrance to the exhibition hall, proved a center of attraction. Many of the visitors were glad to make the booth their headquarters. HEATING AND VENTILATING'S display comprised a degree-day map of the United States in colors, which occupied the entire back of the booth. All of the degree-day lines on the map were shown in electric lights.

In addition, the map was flanked on each side with columns representing, in all, eight typical cities, including New York, Philadelphia, Boston, Pittsburgh, Chicago, Minneapolis, Denver and San Francisco. Each column corresponded in height to the total degree-day load of the heating season for the city it represented, while the monthly loads were given in illuminated sections. As the sections were lighted in sequence, they gave the visitors a clear conception of the way a typical heating load builds up month by month through the heating season.

Pierce Scores Heating Industry

FOLLOWING a full evening of discussion as to whether or not the coal dealer or the heating contractor should sell auxiliary heating equipment, such as stokers, Daniel T. Pierce, vice-chairman of the Anthracite Operators Conference, stated that in his opinion coal dealers should sell equipment, but that the personnel must be made up of a different type of man than they now employ. He stated that the contractors, manufacturers and engineers in the heating industry were largely following practices which were in use 20 years ago.

This announcement came as a climax to the regular monthly meeting of the Anthracite Club of New York City, January 15, at which 143 members and guests were present. The subject of the evening was "Shall the Coal Dealer Handle Equipment?" The principal speaker was Vernon B. Bickmore of the Combustion Specialties Company. He stated that it was up to the coal industry to keep its customers *dissatisfied*, and also stated that the anthracite industry should be shipping 83 million tons instead of 60 million tons annually. An indication that the anthracite industry has come to life is shown by the work of the Anthracite Coal Service and the Frost Research Laboratory. In his opinion, anthracite is still the ideal fuel and the industry is prepared now to prove it.

Mr. Bickmore believes that to burn coal automatically a special boiler or stoker must be supplied. Blowers for burning small-sized coal are not fully automatic even though this method of burning coal is cheap and the blower is operated through a thermostat.

The speaker remarked that eventually the operators will reduce the number of sizes of coal and produce more small-sized anthracite, which may enable a reduction in price.

Leading up to the question of distribution of auxiliary heating equipment, such as stokers, thermostats, etc., he remarked that being a steamfitter no more qualifies a man to be an expert in combustion than selling coal to heating plants makes a coal dealer a steamfitter. In his opinion the steamfitter has no sales organization capable of carrying on an aggressive merchandising campaign to promote the sale and use of auxiliary equipment.

In reply to a questionnaire sent to 300 coal dealers in the Metropolitan area, to which 51 answers were received, 20 replied that they do not handle such equipment; three that they do not favor the handling of such equipment; seven that they do not handle equipment, but favor coal dealers taking on such activity; six are considering or about to begin selling stokers, thermostats, etc., and 15 are already handling such equipment.

In reply to the question "What equipment have you sold in the past?" the answer from one was blowers, stokers and thermostats. The question "How long have you been selling such equipment?" was asked, and two replied, one answer being two months, the other four years. The third question was "If you have discontinued this service, what is the reason?" There was one reply, this man stating that he had lost money on the business.

To the question "What is the reaction of your customers to selling such equipment?" nine replied that the customers were satisfied. Eleven replied in the affirmative to the question "Is such a service successful?" while one replied no. Ten replied in the negative to the question "Have you lost money?" and two answered yes.

In answer to the question "Has such service brought you more business?" five replied no, while six answered in the affirmative. When asked if such service saved the business which might have gone to the oil burner, three replied that it had not, while nine answered yes.

Among the general remarks made by those replying to the questionnaires, one man stated that stokers should be cheaper. Another said that furnaces should be redesigned and made more efficient, while a third stated that the sale of such equipment was excellent from an advertising standpoint.

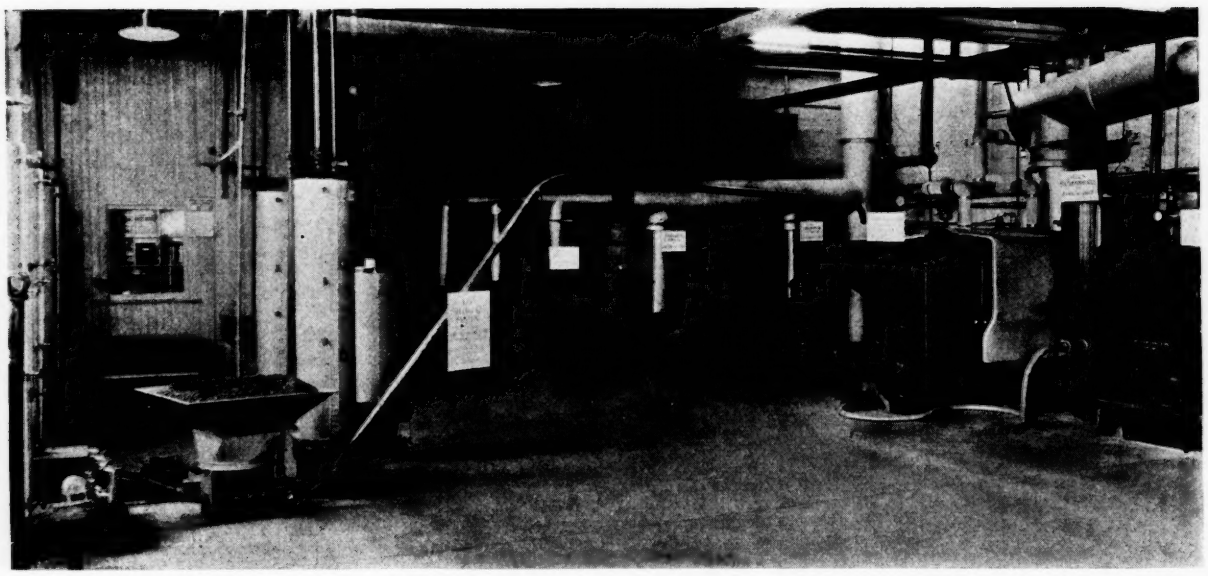
Mr. Bickmore stated that it was entirely possible that residential work, so far as heating auxiliaries are concerned, might be handled by manufacturers who have engineering talent capable of handling such work satisfactorily. These engineers would take care of the installation and servicing.

A representative of a plumbing and heating paper replied to Mr. Bickmore's paper by stating that the 15,000 plumbers who yearly handle over $2,000,000,000 worth of merchandise are surely capable of handling the sale of domestic stokers and other equipment. In his opinion the average coal dealer is not as efficient a merchandiser as the average steamfitter.

The discussion was spirited and lengthy. F. C. Conkey, secretary of the Elizabeth, N. J., Master Plumbers Association, and the Northern New Jersey Coal Dealers Association said that the plumber can not merchandise. In his opinion the coal merchant must go out and sell equipment or it will not be sold. This eventually may wake up the steamfitter and the business then could be turned over to the contractor.

E. E. Finn, director of service, Lehigh Coal and Navigation Co., said that his company had found that the steamfitter knows little about coal and its combustion, and is hardly capable of handling and servicing appliances such as the domestic stoker.

When called upon to speak, Daniel T. Pierce replied to those who felt that the plumber can merchandise by stating that the vice-president of a large heating manufacturing company had told him that the plumbing and heating contractor was the poorest merchandiser in the world. Mr. Pierce stated that if he were in the retail coal business he would become the most competent and able equipment distributor in the business today, so that he could further the sale of his primary product—anthracite.



One of the Interesting Exhibits at the Frost Research Laboratory Was a Blower Coal Conveying System (Shown at Left) and Ash Suction Conveyor (Shown at Right)

Convention Party Inspects Frost Research Laboratory

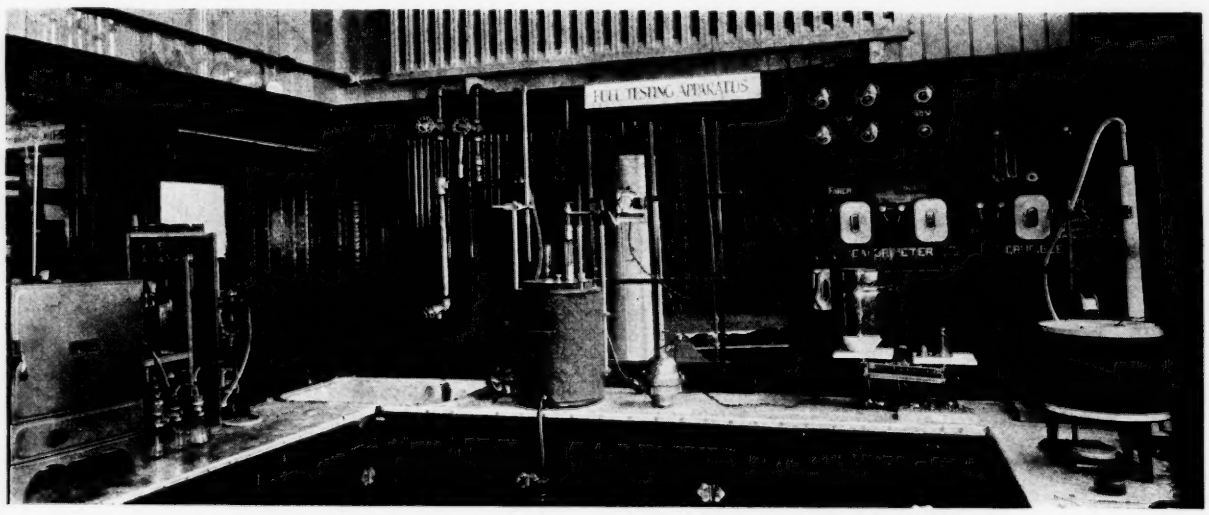
A LARGE party of delegates took advantage of the invitation of the Frost Research Laboratory to visit its plant in Norristown, Pa., Monday afternoon, January 27. Busses left the Benjamin Franklin Hotel late in the afternoon in a blinding snowstorm, but reached the laboratory in time for the guests to partake of a delicious buffet supper, which was cooked, as well as served, in the laboratory.

R. V. Frost, head of the laboratory, with his staff welcomed the visitors. Immediately following the supper, the party split into groups and were assigned to guides who explained the various exhibits, all of which were under test.

One that attracted unusual interest was the Epp blower system for conveying coal to a domestic stoker. This machine, designed by Otto C. Epp, of Scranton, Pa., was in operation, conveying anthracite coal (chestnut and smaller sizes) from a bin to a stoker hopper, 20 ft. away, at a rate of 25 lbs. per min. When used with a timing device, it was explained, the conveyor can be operated automatically without attention.

An Allen Suction ash conveyor, made by the Allen Air Appliance Co., New York, connected to the ash pit in the same installation, removed the ashes from under the stoker and deposited them in a container at one side of the boiler. If necessary, it was explained, the ash container could be placed outside of the building. In this way, an anthracite burning heating plant was provided which is fully automatic and adaptable for operation without attention for indefinite periods.

Other apparatus on display included a wedge circumferential feed stoker for anthracite buckwheat and rice coal, which burns the fuel in a ring fire. It was described as particularly suitable for use under steel



Fuel-Testing Room in Frost Research Laboratory

tubular boilers.

An Electric Furnace Man, operating in a Richardson & Boynton ship range, attracted continuous attention, as it was in this range that the chicken a la king and the potato croquettes, served to the guests, were cooked.

A new induced draft fan, designed by the American Blower Company, was shown in operation, connected to an American Radiator Company Red Jacket boiler.

An American anthracite stoker was on display, built by the American Engineering Company, makers of the Taylor stoker. A large group of the visitors watched the push-feed mechanism and reciprocating grate bars in operation for the progressive feeding of fuel. Ashes were removed through clinker grinders and an ash drag, which deposited the ashes in a nearby receptacle.

Other interesting exhibits included a Franklin stove for burning anthracite for 24-hr. periods, without attention; several anthracite-burning stoves and other types of stokers, not installed for operation. Half a dozen different makes of temperature control devices were included in the display.

Numerous charts showing the results of tests and a complete display of the equipment used to conduct the tests indicated the extent to which the Frost Laboratory is going in its research in the utilization of fuels.

Many of the tests are being conducted for the Anthracite Operators Conference, which is making plans for an extensive campaign to give the public first hand data on modern coal-burning appliances.

At the conclusion of the inspection, the party started for the Commercial Museum in Philadelphia, where they arrived in time to participate in the formal opening of the Heating and Ventilating Exposition.

Heating Board of Trade Organized in New York

At a mass meeting, held January 8 in the Building Trades Employers' Association club rooms, New York, the Heating Board of Trade of New York was formally organized. Its membership comprises contractors, manufacturers, engineers and associations, representing the heating and ventilating industry in the metropolitan district.

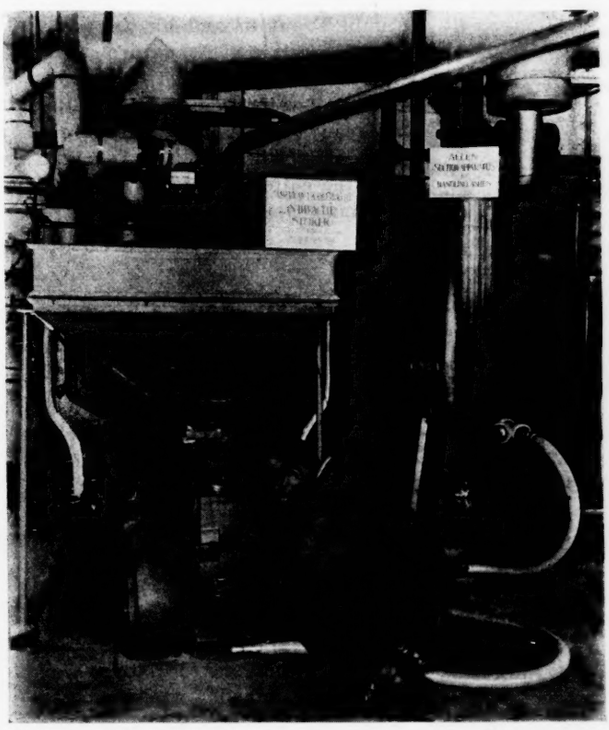
The first meeting was called October 8, under the leadership of the Heating and Piping Contractors New York City Association, with the purpose of promoting an organization to correct undesirable conditions existing in the industry. At that time a committee was named to study all phases of the situation and to determine whether such an organization would fill a particular need and, second to outline the type of organization necessary.

At the second meeting, January 8, which was called to order by Richard A. Wolff, P. R. Mork, of Crane Co., chairman of the Organizing Committee, submitted his report, together with a copy of the proposed constitution and by-laws.

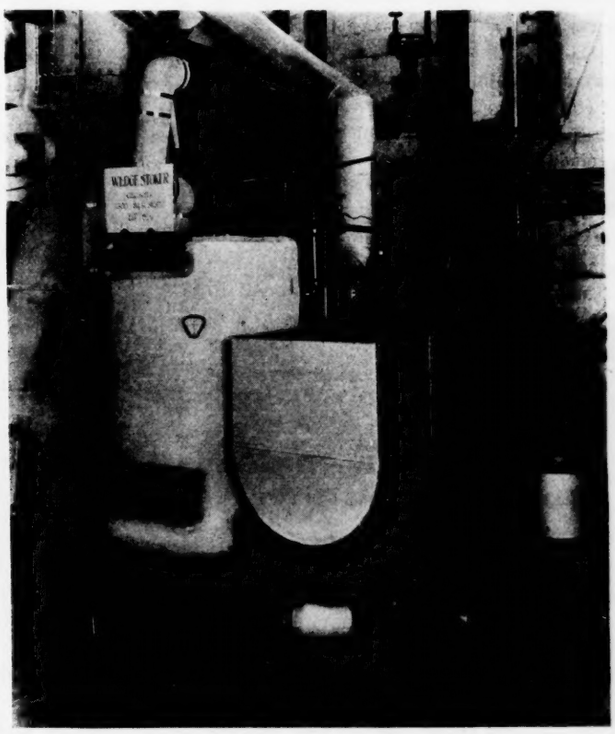
In the report, the Organizing Committee indicated very strongly that it approved of the proposed plan of organizing the Heating Board of Trade. The constitution and by-laws, which were submitted as part of the report, are so constructed as not to conflict in any way with the activities of any present or future organization intended to serve any particular trade in the industry.

Following the formal organization a fee of $25 was fixed, and the temporary secretary, William E. Taylor, executive secretary of the Heating and Piping Contractors New York City Association, was authorized to take applications and collect these fees.

Mr. Taylor states that the membership will be held open until a sufficiently large and representative group have signed applications in order that at the next meeting, which will be of the membership alone, all who are interested in the health of the industry may have an opportunity to take part in the selection of the officers who are to lead this organization.



Demonstration of the Way Ashes Are Removed by Suction to a Separate Tank which May Be Located Outdoors



A Unique Circumferential Stoker which Burns the Fuel in a Ring Fire under Steel Tubular Boiler

American Society of Heating and Ventilating Engineers

District Heating in New York Explained to New York Chapter

At the regular monthly meeting of the New York Chapter, held January 20, central station heating in New York was outlined in a paper by William J. Baldwin, Jr., read by L. J. Phillips, assistant manager of Commercial Relations, New York Steam Corporation. At this meeting, 107 members and guests were present.

It was stated that the functioning of the New York Steam Corporation resulted in eliminating coal and ash carts from the congested streets of the city to the extent of 1,250,000 tons, which is equivalent to 1400 three-ton truck loads each day for 300 days of the year. During the year 1929, 20,000 ft. of new mains were laid, and of these 9000 ft. were 24 in. in size. Steam mains generally are laid approximately 5 ft. below street level, but it is often necessary to go 18 or 20 ft. deep. It was pointed out in the paper that for a small bank and trust company building the utility cost for steam was $5700, while it would have cost this building $11,604 to have generated their own steam. A similar operation for a small fraternity house showed the cost of utility service to be $2380, as compared with $3547 if steam would have been generated on the premises.

Each of the four boilers in the Kip's Bay station burns approximately 15 tons of coal per hr., and generates an average of 375,000 lbs. of steam in the same period. It was pointed out that close cooperation between the steam corporation and the electric utility in New York results in lower rates than would otherwise be possible, due to an interchange of steam at off-peak hours, the peak in the steam corporation occurring at different hours than the peak of the electric power utility.

Michigan Chapter Hears Talk on Detroit River Tunnel

At the regular monthly meeting of the Michigan Chapter, held at the Cadillac Athletic Club, Detroit, January 13, Soren Thorensen, engineer of designs of the Detroit and Canada tunnel, gave an illustrated lecture covering in detail the design of the tunnel under the Detroit River. He pointed out that in the ventilation of this tunnel, fresh air is admitted through the floor and is exhausted from the top of the tunnel, 42 air changes per hour being supplied.

Prof. W. D. Henderson, director of the extension division of the University of Michigan, gave an address on "What the Machine Age is Doing for Us and to Us." Professor Henderson declared that the time rate of change at the present is the greatest in all history, and that the change during the next 25 years will influence the world for the next 1000 years.

Ninety-four members and guests were present.

New Officers of Philadelphia Chapter

New officers of the Philadelphia Chapter, elected at the chapter's January meeting, are: President, H. G. Black; vice-president, E. N. Sanbern; secretary, L. C. Davidson; treasurer, W. H. Wild. Board of governors, A. C. Edgar, A. J. Nesbitt and M. F. Blankin. R. C. Bolsinger was named as delegate and A. J. Nesbitt as alternate representative of the chapter on the A. S. H. V. E. Nominating Committee.

President Edgar introduced the new officers. As Mr. Black took the chair, he was presented with a basket of flowers on behalf of his friends and associates.

New Edition of "Ideal Fitter"

"The Ideal Fitter," published by the American Radiator Company, has long been one of the most popular handbooks of the heating industry, and engineers and contractors will be glad to know that the 54th edition is now off the press.

The new edition is considerably enlarged and changed, the most important difference between this edition and previous ones being that boiler ratings are given in multiple for various rates of combustion. Ratings are based on a heat value of 12,500 B.T.U. per lb. for hard coal, and 13,000 B.T.U. per lb. for soft coal. A curve shows the percentage of increase or decrease of the outputs when burning fuel having heat values less or more than 12,500 for hard coal.

Other conditions on which the ratings are based are a 2-lb. gauge pressure for steam boilers, and 180° water temperature for water boilers; a heat emission of 240 B.T.U. per sq. ft. of steam radiation and 150 B.T.U. for water radiators.

Hard coal outputs are based on the use of anthracite of commercial size, moisture free, with chimney dimensions as specified. Soft coal outputs are based on the use of bituminous, free-burning or caking 3 in. x 2 in. lump size, moisture free, with chimney dimensions as specified, with stoking and firing attention as required. Oil-burning outputs are based on the use of commercial fuel oil, 19,000 B.T.U. heat value per lb.

Boiler data are given for Arcola, Arcoflash, Arco round boilers, Redflash and water tube boilers, Redflash Smokeless, Ideal Smokeless boilers, Arco round oil-burning, Redflash oil-burning, Ideal oil-burning and Ideal water tube oil-burning boilers.

Additional data have been prepared for Ideal gas boilers, water heaters, hot water supply boilers and Vecto heaters. Colored plates, drawings and illustrations feature the Corto and Peerless radiators, Vento heaters, radiator accessories, Arco metal pipe.

An engineering section of 73 pages contains valuable tables, data, formulas and sizes for use in connection with heating calculations. Size 5¼ in. x 7½ in. Pp. 413.

An Apology

In the rush incident to publishing the International Heating and Ventilating Exposition Supplement, no credit was give the American Radiator Company for their generosity in allowing us to reproduce the painting depicting Benjamin Franklin and his friends warming themselves at Franklin's stove. This was shown on page 7 of the Supplement. Especially since the American Radiator Company has always cooperated so splendidly with HEATING AND VENTILATING, the editors sincerely regret the unfortunate omission.

Seattle Heating Contractors Adopt Certification

The Heating and Piping Contractors Seattle Association, Seattle, Wash., has voted for certification of all work, effective January 1, 1930. E. G. Byrd, organizer for the Heating and Piping Contractors National Association, was the prime mover in promoting certification in Seattle.

Heating and Piping Contractors District of Columbia Association, Washington, D. C., announces a change of address from 710 14th St., N. W., to Room 323, Oyster Bldg., 2539 Pennsylvania Ave., N. W.

Correspondence

Pipe Sizes with Closed Water System

EDITOR HEATING AND VENTILATING:

In the past and the present heating contractors are installing hot water heating systems using some kind of valve causing a pressure on the system other than gravity.

The practice is to reduce the pipe size all through the system, thereby reducing the cost of labor, pipe and fittings.

I have in the past installed hot water heating systems in accordance with the standards adopted by the American Society of Heating and Ventilating Engineers, and have had very good results, and should like to continue to do so, but cannot meet competition when the other fellow cuts his costs on labor, pipe and fittings. Will you be so kind as to give me some information on this?

E. R.

Evanston, Ill.

Theoretically, it is true that with a pressure hot water system the pipe sizes can be somewhat smaller than in a gravity system, due to the higher water temperatures that can be carried. But with a correctly figured gravity system, small pipe sizes can also be used, even as small as ½ in. and ¾ in. for risers and radiator connections. Pipe sizes smaller than these would not be used, for structural reasons. Therefore there is not much difference in cost between the two systems as far as pipe sizes are concerned, and none as far as labor is concerned.

National Publicity for Certified Heating

EDITOR HEATING AND VENTILATING:

Your publication is certainly to be congratulated upon the wonderful write-up in your November issue of Mr. Durkee's remarks before the New York Chapter of the A. S. H. V. E.

I feel sure that sooner or later we are going to get the endorsement of the society's various chapters in localities where "Certified Heating" is properly being operated. What I should like to see at this time is the endorsement of "Certified Heating" by the Institute of Boiler and Radiator Manufacturers of the United States and then have the secretaries, in cities where "Certified Heating" is in operation, get the endorsement of local chapters of architects and all other allied associations concerned with radiator heating.

After this is done, or, rather, while this is being done, the entire industry should prepare a constructive publicity program. Personally, I feel that the broadcasting of "Madame Butterfly" or a similar program should be the function of the boiler manufacturer's Institute and that all announcements should emphasize the health and comfort to be obtained through radiator heat, without the mention of any manufacturer or the knocking of other methods of heating.

The idea of radiator heating should then be sold through national publications by the manufacturers, using their names in connection with this advertising, but emphasizing health and comfort of radiator heat.

Wherever there is a contractors' association, there should be a publicity committee, made up of various branches of the industry. A campaign to cover a period of three years should be organized to educate the public along the lines above mentioned and then, in the cities where certified heating is in operation, the contractors' association and its members, with endorsements such as mentioned above, would have no trouble in educating the public to understand that "Certified Heating" is a service to the public. This cannot be done without advertising and publicity.

When we think of the wonderful publicity that the radio industry receives, through broadcasting alone, and then add to this the amount of money which is spent by advertising and publicity in every conceivable way and compare this with the amount of money spent by the heating industry, we should be ashamed of ourselves.

They say that in the final analysis, "it is the health of a nation that either makes or breaks it." Certainly the advantage we have in this respect should put us out in the front in the estimation of the public and we will be in our rightful place when we educate the public to the service of "Certified Heating."

We are now in the piker's position because our customers do not know and we have not tried to educate them in the language which they could understand. The public understands what health and comfort mean to any community, but it does not and never will understand the technical points of a heating system.

I know of no part of the industry, so far as health and comfort are concerned, that plays any more important part than adequate heating. "Certified Heating" guarantees the owner an adequate heating system and that any adjustment necessary to meet the guarantee will be made without loss to the owner. That is service to the public.

In a campaign such as I have in mind, I would use all forms of advertising, newspapers, periodicals, direct mail, billboards, radio, and all the personal contact the entire industry could produce. The population of the three counties covered by the labor agreement of the Heating and Piping Contractors Cincinnati Association is about 750,000. Taking our locality as an example, how much should we raise each year for a period of three years to adequately do the job?

A. BACHMAN,
Secretary, Heating and Piping Contractors Cincinnati Association.

Estimating the Size of Steam Water Heater

EDITOR HEATING AND VENTILATING:

I have a house with 830 sq. ft. of cast-iron radiation served with hot water from a sectional boiler. We wish to replace the boiler with a steam water heater, steam being supplied from an outside plant. Will you please tell me where I can find out how to estimate the proper size of heater. Steam can be supplied at 25 lbs. gauge. I estimate the steam required to do maximum heating would be 155 lbs. per hr.

E. A. W.

Ithaca, N. Y.

830 sq. ft. of direct radiation should be figured on the basis of transmitting 200 B.T.U. per sq. ft. of radiation surface, which is a total of 166,000 B.T.U.

Based on gravity circulation of water, a temperature drop of 30° should be considered. This would mean the circulation of 5533 1/3 lbs. of water per hr.

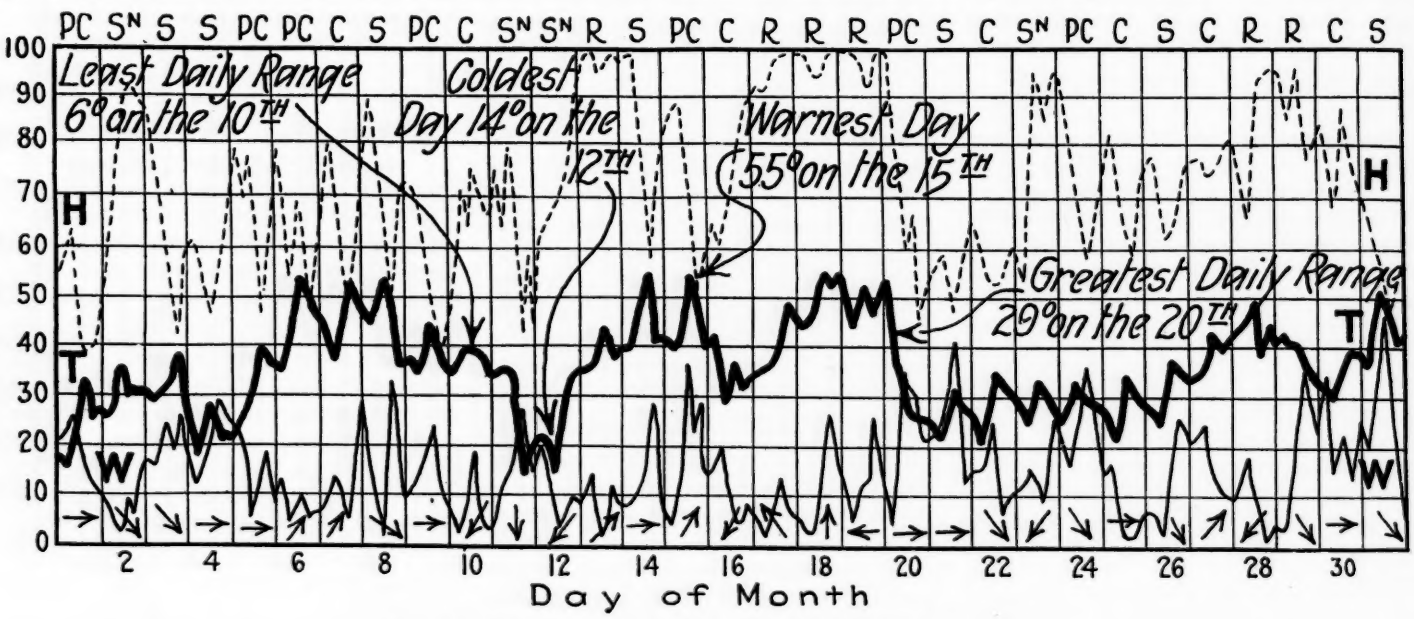
The latent heat of steam at 25 lbs. pressure is 933.3. To this should be added 67.3° of heat which would be available with steam at 25 lbs. pressure in reducing its temperature in condensing to a temperature of 200° in the condensate.

This will, therefore, provide 1000 B.T.U. in each pound of steam available for transmitting to the water for this radiation surface so that 166 lbs. of steam per hour at 25 lbs. pressure will be required.

The proper size hot water convertor to take care of this radiation will be one with not less than 15 sq. ft. of seamless drawn copper tube heating surface.

The Weather for December, 1929

	New York	Boston	Pittsburgh	Chicago	St. Louis
Highest temperature, deg. F.	55	52	63	47	69
Date of highest temperature	15	14	17	13	11
Lowest temperature, deg. F.	14	7	8	1	6
Date of lowest temperature	12	12	1	3	20
Greatest daily range, deg. F.	29	26	22	23	23
Date of greatest daily range	20	23	18	24	5
Least daily range, deg. F.	6	5	4	4	4
Date of least daily range	10	10	29	15	16
Mean temperature for month, deg. F.	36.1	32.6	34.6	28.6	37.5
Normal mean temperature for month, deg. F.	35.0	32.5	34.2	28.8	34.9
Total precipitation, this month, inches	3.23	4.43	2.15	1.84	3.07
Total snowfall, this month, inches	5.7	10.6	11.4	20.2	6.7
Normal precipitation, this month, inches	3.62	3.45	2.73	2.04	2.21
Total wind movement, this month, miles	9971	5312	7683	7545	8374
Average hourly wind velocity, miles	13.4	7.0	10.3	10.1	11.3
Prevailing direction of wind	W	N.W.	S.W.	W	S.W.
Number of clear days	6	7	1	4	10
Number of partly cloudy days	8	11	6	3	6
Number of cloudy days	17	13	24	24	15
Number of days with precipitation	11	13	15	14	11
Number of days with snowfall	4	7	7	10	5
Snow on ground at end of month	None	Trace	Trace	2.5	None


PC SN S S PC PC C S PC C SN SN R S PC C R R R PC S C SN PC C S C R R C S
Least Daily Range 6° on the 10TH
Coldest Day 14° on the 12TH
Warmest Day 55° on the 15TH
Greatest Daily Range 29° on the 20TH
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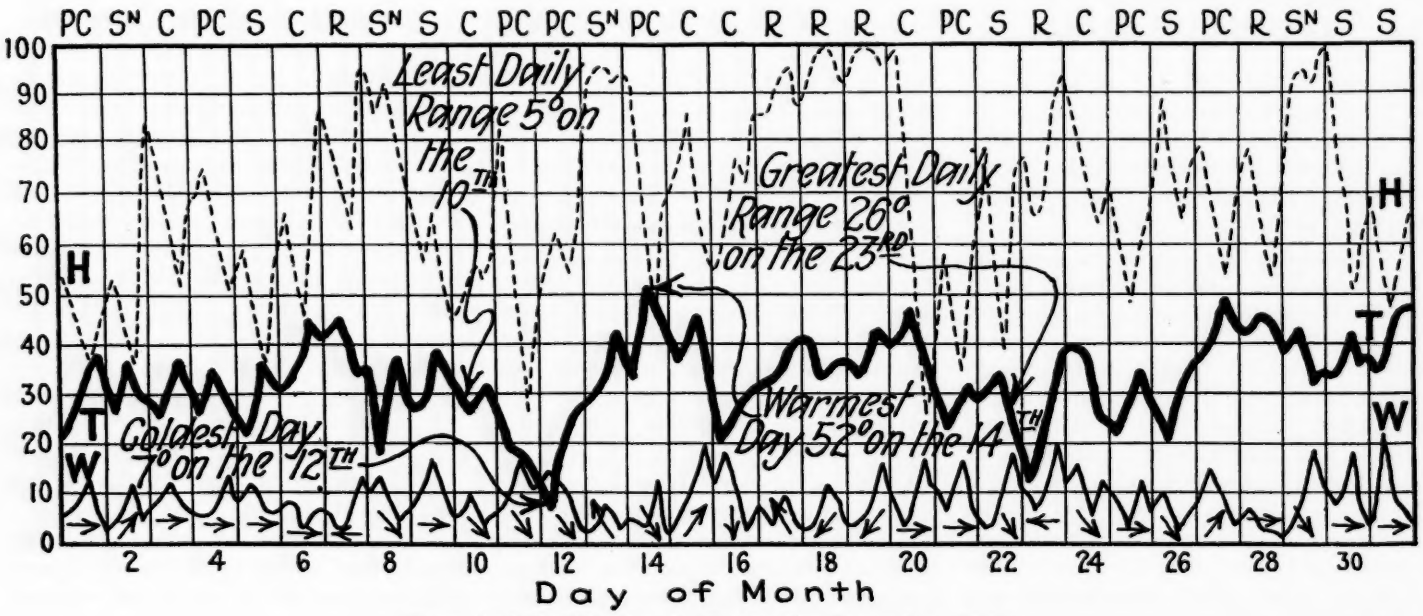
2 4 6 8 10 12 14 16 18 20 22 24 26 28 30
Day of Month

Record of the Weather in New York for December, 1929
(Hourly Observation of the Relative Humidity Plotted on this Chart)


PC SN C PC S C R SN S C PC PC SN PC C C R R R C PC S R C PC S PC R SN S S
Least Daily Range 5° on the 10TH
Greatest Daily Range 26° on the 23RD
Coldest Day 7° on the 12TH
Warmest Day 52° on the 14TH
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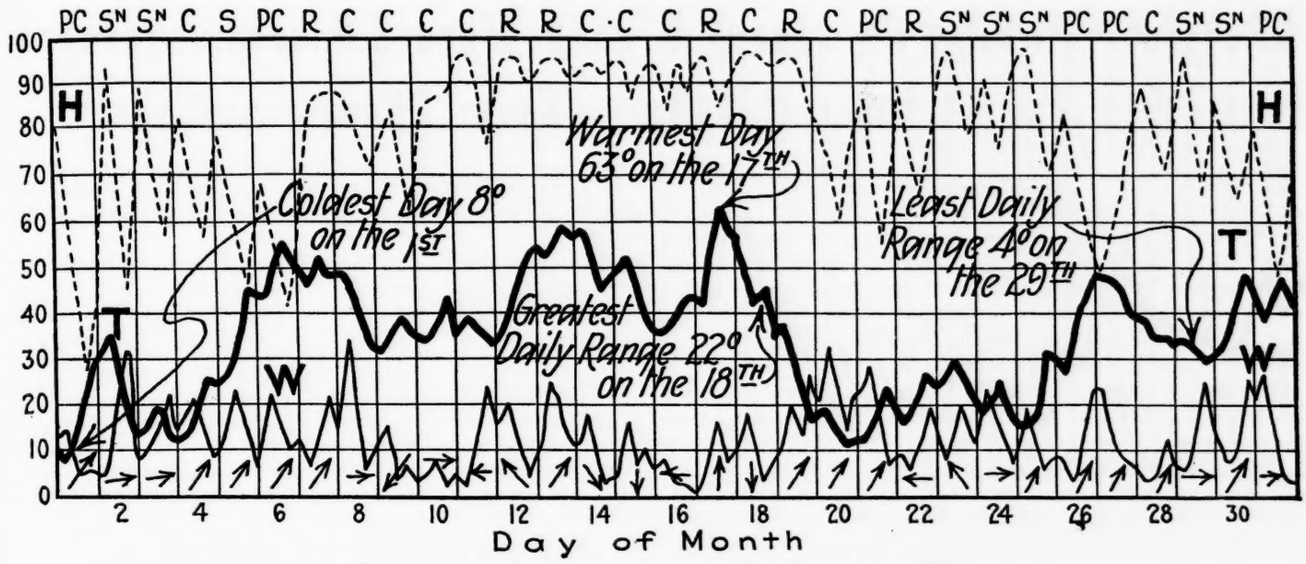
2 4 6 8 10 12 14 16 18 20 22 24 26 28 30
Day of Month

Record of the Weather in Boston for December, 1929


PC SN SN C S PC R C C C C R R C C C R C R C PC R SN SN SN PC PC C SN SN PC
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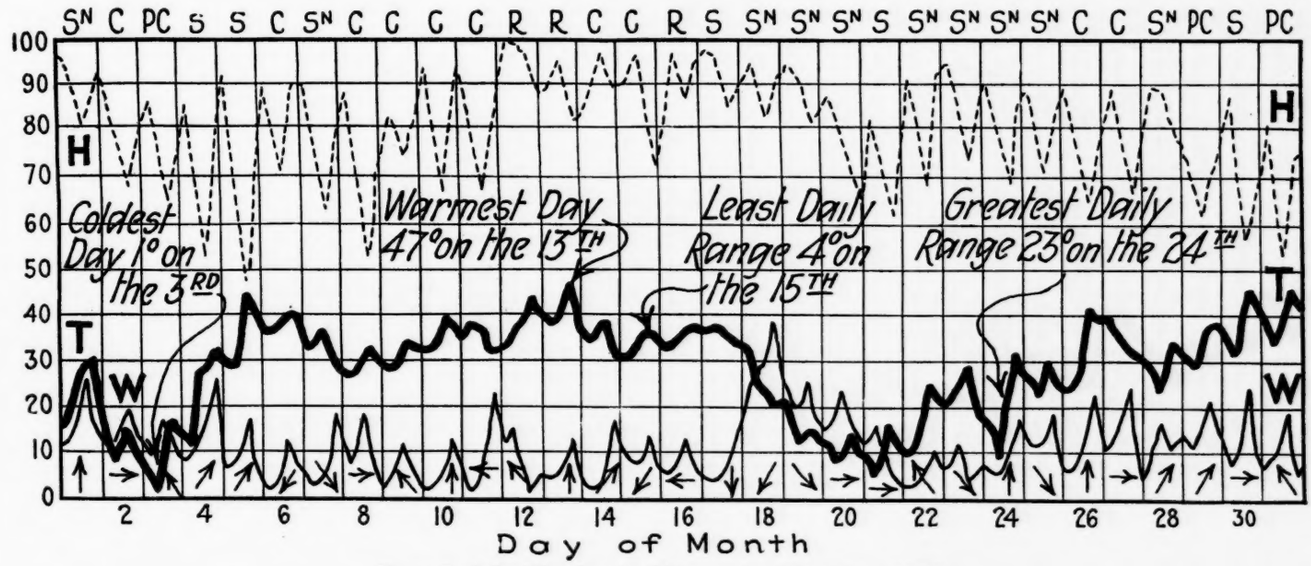
Coldest Day 8° on the 1ST
Warmest Day 63° on the 17TH
Greatest Daily Range 22° on the 18TH
Least Daily Range 4° on the 29TH
Day of Month

Record of the Weather in Pittsburgh for December, 1929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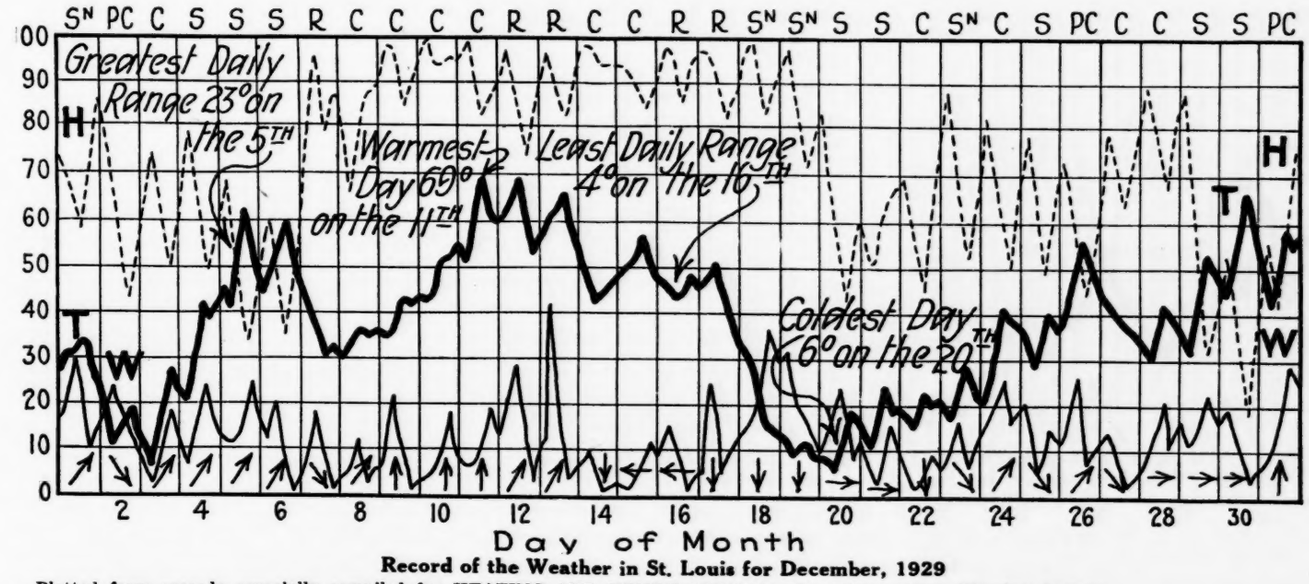
Coldest Day 1° on the 3RD
Warmest Day 47° on the 13TH
Least Daily Range 4° on the 15TH
Greatest Daily Range 23° on the 24TH
Day of Month

Record of the Weather in Chicago for December, 1929


SN PC C S S S R C C C C R R C C R R SN SN S S C SN C S PC C C S S PC
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Greatest Daily Range 23° on the 5TH
Warmest Day 69° on the 11TH
Least Daily Range 4° on the 16TH
Coldest Day 6° on the 20TH
Day of Month

Record of the Weather in St. Louis for December, 1929

Plotted from records especially compiled for HEATING AND VENTILATING by the United States Weather Bureau.
Heavy lines indicate temperatures in degree F. Light lines indicate wind in miles per hour.
Broken lines indicate humidity in percentage from readings at 8 A.M., 12 M., and 8 P.M. Arrows fly with prevailing directions of wind.
S—clear, PC—partly cloudy, C—cloudy, R—rain, Sn—snow.

Degree-Days and Unit Fuel Consumption in Nine Cities for December

IN addition to the monthly totals in degree-days presented for nine typical cities, the unit fuel consumption for these cities for the month of December is included. The figures are given in pounds of coal, gallons of oil, and cubic feet of gas per square foot of steam radiation for the month of October, calculated on the basis of radiation installed for a zero to 70° temperature difference and an efficiency of 100%.

Corrections must be made for efficiencies, heat content of fuel other than that listed below, for radiation emitting other than 240 B.T.U. per hr., and for radiation calculated on a basis of other than zero to 70°.

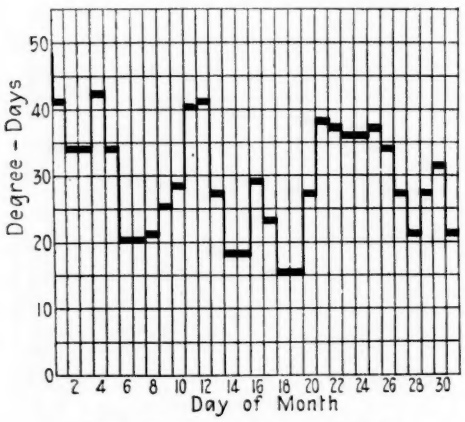
Coal is assumed as having a heat content of 12,000 B.T.U. per lb., gas, 1000 B.T.U. per cu. ft., and oil 140,000 B.T.U. per gal. To correct for other heating values, multiply the fuel consumption listed under the charts by the standard heat content just listed, and divide by the heat content in question.

To correct for efficiency, divide the fuel consumption by the efficiency of the heating installation.

For water radiation, multiply the fuel consumption, which is given for steam radiation, by ¾.

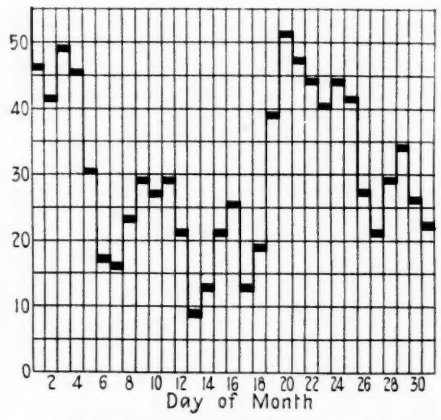
If fuel consumption is estimated for radiation installed for —10° outside temperature, multiply the fuel consumption by 7/8. If the radiation was calculated for +10°, multiply by 7/6.

In other words, for radiation installed for any other outside temperatures than zero, multiply the fuel consumption given under the charts by 70°, divided by the quantity (70 minus the outside temperature used).



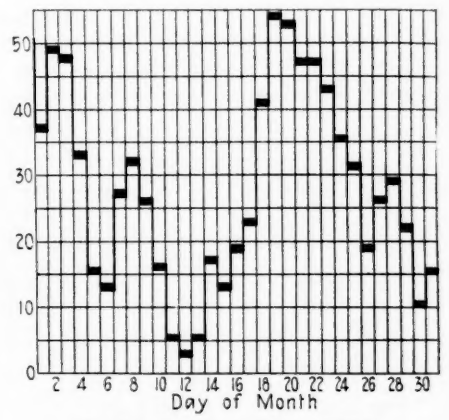
New York, December, 1929
Degree-Days 897—to Date, 1861

Lbs. of Coal per Sq. Ft. of Radiation for this Month, 7.176
Gals. of Oil per Sq. Ft. of Radiation for this Month, 0.615
Cu. Ft. of Gas per Sq. Ft. of Radiation for this Month, 86.11
(See Footnote)



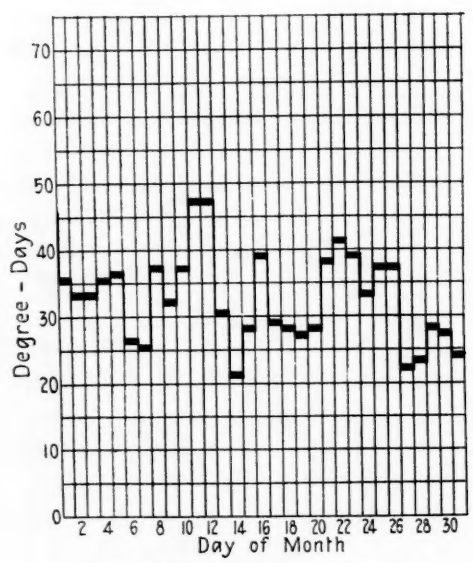
Pittsburgh, December, 1929
Degree-Days 938—to Date, 2149

Lbs. of Coal per Sq. Ft. of Radiation for this Month, 7.50
Gals. of Oil per Sq. Ft. of Radiation for this Month, 0.643
Cu. Ft. of Gas per Sq. Ft. of Radiation for this Month, 90.05
(See Footnote)



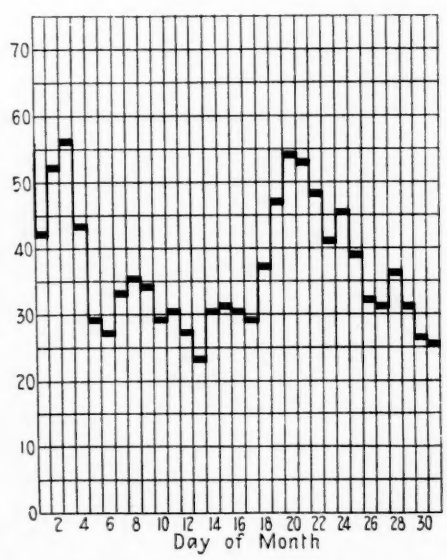
St. Louis, December, 1929
Degree-Days 853—to Date, 1820

Lbs. of Coal per Sq. Ft. of Radiation for this Month, 6.82
Gals. of Oil per Sq. Ft. of Radiation for this Month, 0.585
Cu. Ft. of Gas per Sq. Ft. of Radiation for this Month, 81.89
(See Footnote)



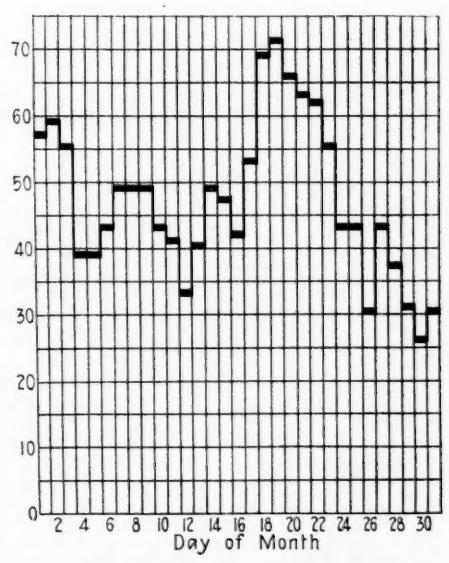
Boston, December, 1929
Degree-Days 1002—to Date, 2091

Lbs. of Coal per Sq. Ft. of Radiation for this Month, 8.02
Gals. of Oil per Sq. Ft. of Radiation for this Month, 0.687
Cu. Ft. of Gas per Sq. Ft. of Radiation for this Month, 96.19
(See Footnote)



Chicago, December, 1929
Degree-Days 1125—to Date, 2461

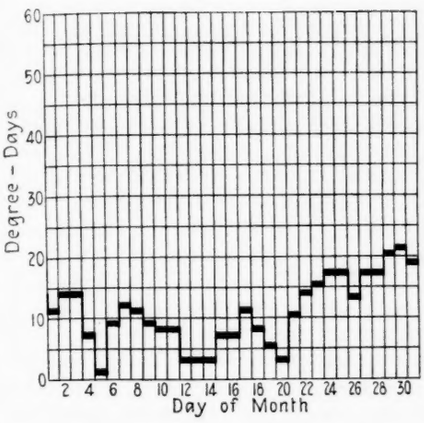
Lbs. of Coal per Sq. Ft. of Radiation for this Month, 9.00
Gals. of Oil per Sq. Ft. of Radiation for this Month, 0.771
Cu. Ft. of Gas per Sq. Ft. of Radiation for this Month, 108.00
(See Footnote)



Minneapolis, December, 1929
Degree-Days 1456—to Date, 3257

Lbs. of Coal per Sq. Ft. of Radiation for this Month, 11.65
Gals. of Oil per Sq. Ft. of Radiation for this Month, 0.998
Cu. Ft. of Gas per Sq. Ft. of Radiation for this Month, 139.78
(See Footnote)

These figures must be corrected for local conditions as explained above.

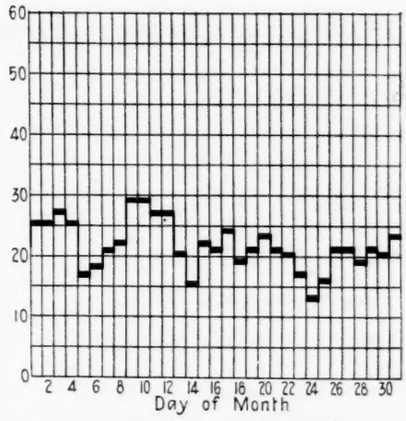


San Francisco, December, 1929

Degree-Days 334—to Date, 709

Lbs. of Coal per Sq. Ft. of Radiation for this Month, 2.67
Gals. of Oil per Sq. Ft. of Radiation for this Month, 0.229
Cu. Ft. of Gas per Sq. Ft. of Radiation for this Month, 32.06

(See Footnote, page 116)

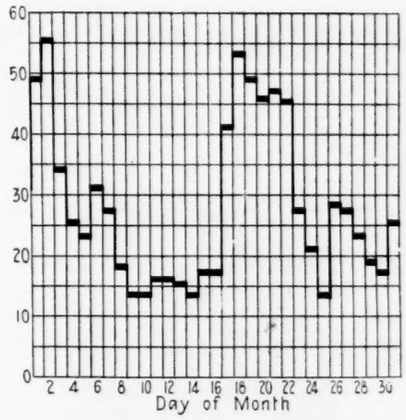


Seattle, December, 1929

Degree-Days 669—to Date, 1701

Lbs. of Coal per Sq. Ft. of Radiation for this Month, 5.34
Gals. of Oil per Sq. Ft. of Radiation for this Month, 0.459
Cu. Ft. of Gas per Sq. Ft. of Radiation for this Month, 64.22

(See Footnote, page 116)



Denver, December, 1929

Degree-Days 863—to Date, 2526

Lbs. of Coal per Sq. Ft. of Radiation for this Month, 6.90
Gals. of Oil per Sq. Ft. of Radiation for this Month, 0.592
Cu. Ft. of Gas per Sq. Ft. of Radiation for this Month, 82.85

(See Footnote, page 116)

Death of Archer A. Landon

Archer A. Landon, president of the Landon Radiator Company, and formerly vice-president of the American Radiator Company and a business leader in Buffalo for 20 years, died at the Millard Filmore Hospital in Buffalo, January 6. Mr. Landon was born in Detroit 61 years ago. He took an active interest in work of trade unions and served for a time as president of the associated labor unions in Detroit. At the time of the World War this experience was helpful to him, and he became an advisor to President Wilson on labor conditions in the country. He also served as a dollar-a-year man during the war on the Aircraft Board. In 1926, he organized the Landon Radiator Company at North Tonawanda, N. Y., and served as president until his death.

Mr. Landon was a former president of the Buffalo Chamber of Commerce and a member of the United States Chamber of Commerce.

John A. Stevens

John Amos Stevens, consulting engineer specializing in light, heat and power, died at the age of 61 at his home in Lowell, Mass., after a long illness. During his career, he was granted a number of patents on steam boilers, superheaters and shock-absorbing devices. In 1911, he was appointed chairman of the Boiler Code Committee of the A.S.M.E., holding that position until 1925, when he was appointed honorary chairman. He was a member of the original Massachusetts Board of Boiler Rules, on which he represented the "boiler-using" interests. He continued his membership on this board for a number of years, and was active in the compilation and publication of the rules for the manufacture and inspection of stationary steam boilers in Massachusetts issued by the Board in 1909.

Mr. Stevens created a trust fund under the auspices of the A.S.M.E., known as the John A. Stevens Trust Fund, the principal of which amounts to $24,000. The income of this money is to be paid annually to Mr. Stevens' two sons during their lives, after which it will revert to the A.S.M.E. to establish an award to persons who have been responsible for an invention in engineering having to do with progress in the conservation of fuels in the generation of light, heat and power.

F. W. Peterson

F. W. Peterson, treasurer of the Mercoid Corp., Chicago, passed away at his home, December 20, at the age of 70. Mr. Peterson served as foreman of various machine shops of the C. & N. W. Railway for about 12 years, and, in 1912, was made manager of the service department of the Oxweld Railroad Service Company, which position he held for five years. In 1919, Mr. Peterson was made manager of the Federal Specialty Mfg. Co., which now is a part of the Mercoid Corporation, of which Mr. Peterson was treasurer and manager of shops, until the time of his death.

Arthur E. Rudolphi

Arthur E. Rudolphi, president and general manager of the Rudy Furnace Co., died at his home in Dowagiac, Mich., December 16. Mr. Rudolphi became identified with the Beckwith Company about 35 years ago, serving as a salesman and later as assistant to the sales manager and manager of the furnace sales department. After 20 years in this work he left the Beckwith Company in 1914, and a year later founded the Rudy Furnace Company.

How to Write a Business Letter

Writing letters, very often letters with important consequences, is a responsibility that no one in business can escape. Good letters have much to do with building success. Clumsy or tactless letters are almost sure to cause trouble. "How to Write a Business Letter," by M. G. Fottler, research assistant, College of Business Administration, Boston University, contains specific suggestions and guidance for writers of business letters. There are twenty-one chapters which supply a well-organized presentation of the subject of writing more effective letters. The book is filled with examples of letters drawn from the correspondence of numerous leading firms. It contains hundreds of concrete illustrations pointing out common errors, and showing how to correct them.

Six chapters are devoted to standards of good usage in letters. These deal with the sort of stationery to use, letterhead design and arrangement, how to place the letter on the page, typing, correct punctuations, etc. Five chapters deal with improving effectiveness of expression. They take up choice of words, how to avoid trite terms and jargon, essentials of grammar, sentence construction, and developing ideas in paragraphs.

Size 6 in. x 8¾ in. Pp. 283. Price $2.75. Published by The Ronald Press Company, or may be secured from our Book Department, HEATING AND VENTILATING, 521 Fifth Ave., New York.

Heating and Ventilating Industry Signally Honored

Fenton B. Turck, Jr., Chairman, National Building Survey Conference and Vice-President, American Radiator Company

by **HOWARD MYERS**

President, National Trade Journals

Publishers of Heating and Ventilating and Fifteen Other Business and Professional Journals

I HAVE just come from an interview with Fenton B. Turck, Jr., and hope that I have carried away a small part of the enthusiasm which he has generated in organizing the building industry to carry out in a practical way the program developed at the recent Washington Conference under the sponsorship of President Hoover.

As chairman of the National Building Survey Conference, Mr. Turck has dropped his normal arduous duties as commercial vice-president of the American Radiator Company to give the necessary direction and impetus to plans which are to be immediately effective throughout the building field. Every agency from manufacturers to architects is being called on to give its wholehearted support, and the response already has suggested the fine spirit which evidenced itself during the war when, once before, industries and the professions were called upon to organize and meet a situation.

"The immediate purpose of the campaign," said Mr. Turck, "is to stimulate building activity during the next three months, in advance of the anticipated summer building rush, to the end that construction may progress at an even pace and that labor may be available at all times for the proper completion of contemplated projects.

"Of particular interest to the conference is the attitude of individuals and corporations on the subject of industrial and commercial building. The conference will urge that as much as possible of such construction be started prior to May 1, so that the way may be clear after that date for normal summer building. The importance of this comes from the fact that commercial and industrial building approximate 30% in money value of the total spent in the building industry. The money supply for this type of building generally is independent of the mortgage market as this money is supplied from the treasuries of industrial concerns which enjoy the ability to discount their paper through banks."

Mr. Turck also pointed out that the cooperation of banks, mortgage companies and building and loan associations will be invited in financing meritorious construction projects at this time. An effort will be made to have loan applications handled promptly and in such a manner as to maintain interest in building. They will be warned against the dangers of unjustifiable delays which might mean eventual labor shortage and higher commodity prices.

Committee Appointed to Plan City Code to Cut Building Costs

An advisory committee of 220 members was appointed during December to meet with engineers and experts as representatives of the public, to draft a new municipal building code designed to save New York builders approximately $56,800,000 annually. Soon after their suggestions and comments have been received, the plan will be turned over to Mayor James J. Walker of New Yo k.

John Lowry, chairman of the committee organized by the merchants Association at the request of Mayor Walker to draft a new code, announced that the new committee will be headed by Irving T. Bush, president of the Bush Terminal Company. The members have been chosen from widely divergent interests, 125 being laymen and the other 95 technical experts.

Among those on the committee are: L. K. Berman, Heating and Piping Contractors New York City Association; William H. Gompert, Architectural League of New York; Gustave B. Kehrt, New York Superintendents Association, Inc.; A. J. Offner, American Society of Heating and Ventilating Engineers; Charles N. Shaw, American Society of Building Managers and Engineers; William H. Wallis, Plumbing and Piping Contractors Association.

In brief, these changes include making room in the new code for developments in the manufacture and use of structural steel, since the present code was prepared fifteen years ago; to make more liberal the provisions concerning the physical properties of building materials; to provide for more stringent inspections, and to secure better and cheaper building.

How One Boiler Manufacturer Met Changed Business Conditions

Discussing the uncontrollable factors of business, the story is told by the *Nation's Business* of a boiler manufacturer in Northern Pennsylvania who, long before the day of oil-burning furnaces and electric refrigeration, lived, prospered and made an increasing number of boilers each year at a fair profit. With the Great War, he expanded his production and sales facilities, to meet the over-night demand for boilers, and sold a greater number than before.

But with the close of the war, orders fell off, sales hit new low levels. The business bugaboo of over-production and under-distribution combined to present a problem which, at first glance, seemed impossible of solution. Red ink began its crimson parade across the ledger and the manufacturer of boilers set about to get the answer.

First, he carefully checked and rechecked every process in his business over which he had control. Plant efficiency was higher than ever before, quality of product was A-1, production costs were low. Then he looked to the externals and there he found the answer.

Today that manufacturer still is making boilers, but he is also making oil-storage tanks for oil-burning heating plants. His factory is running full time. He had looked to the externals, found and used the X-factor needed, adjusted his business to it, and warped new success out of certain failure.

Our boiler manufacturer couldn't control the demand for boilers. That demand, changing, shifting, was an external of his business. But he could discover another external, which solved his problem. He found a new industry that had created a new market for his product.

Present Practice in Water Heating

VIII. Forced Circulation Units

AN advance in hot water heating practice is represented by the introduction, during the past few years, of motor-driven propeller units, pumps, circulators and impellers, which force the heated water through the boiler to the radiators. The value of forced circulation on an old system is that there is a fuel saving and heat is delivered without delay to all radiators regardless of location.

In gravity systems, the effective mean temperature in the radiator is always lower than the flow temperature at the boiler, and the return temperature is still lower. By the use of forced circulation the flow temperature at the boiler is dropped to practically the effective mean temperature of the radiator.

In many gravity installations there are certain radiators which are difficult to heat. Forced circulation provides a means for supplying these radiators, such as those on the same floor as the boiler; those in a separate building or lower floors, so that their effective temperature will be nearly equal to that at the boiler. In greenhouses, forced circulation offers an even temperature in the pipe lines from end to end.

Another advantage of the use of these devices is to reduce the time lag between the call from the thermostat and the response from the boiler.

This is due to the fact that the forced circulation unit can be connected directly to the thermostat.

For use on a system equipped with a mechanically-driven oil burner, the motor on the forced circulation unit can be connected in multiple with the oil-burner motor. In case of a gas-fired boiler, the circulating unit motor can be controlled by a limit control placed in the flue pipe, so that when the flue gases reach a minimum temperature the motor will start and circulate the water.

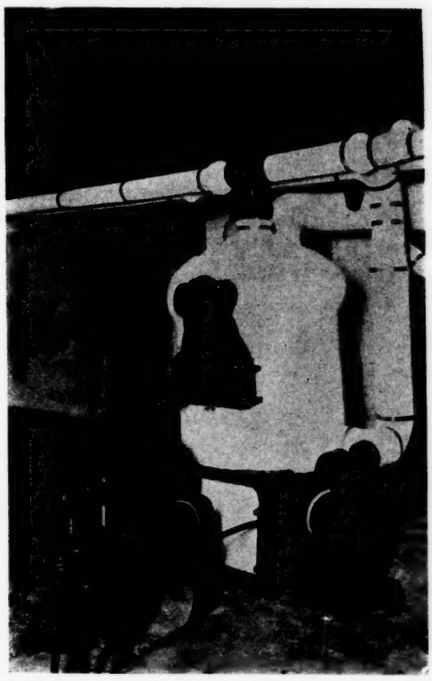
In the case of coal-fired boilers, the motor can be controlled through a limit control in the stack, or through the damper regulator.

In case there is more than one boiler serving the same lines, all of the return lines should be brought through the same tee and afterwards split again to enter the return openings of the several boilers.

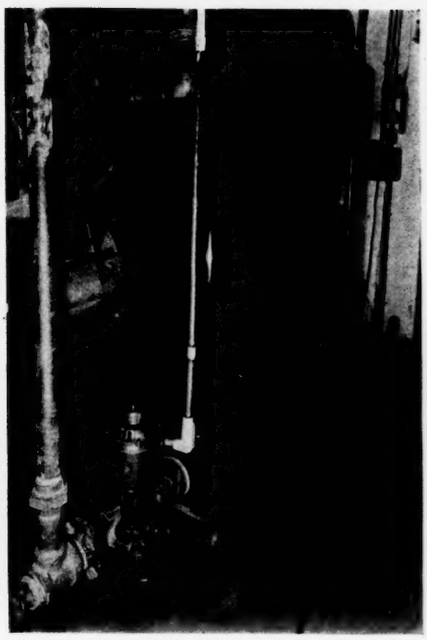
Another use of the circulator is in domestic water systems where the smaller sized circulators may be used. In domestic hot water circulation lines the unit should be placed between the last fixture and the storage tank on the return side. In domestic water heaters using steam boilers, these units can be used to circulate the steam boiler water, particularly when the boiler is not being used to heat the building.

The accompanying photographs show that all that is necessary to install these devices in systems which are not giving satisfaction is to cut into the return line or, in the case of some units, to cut into the tee and place the unit on the extra outlet. Such units are sometimes placed in the boiler outlet and sometimes in the return. They are manufactured by the Janette Mfg. Co., Chicago; H. A. Thrush & Co., Peru, Ind.; Rochester Circulator Co., Rochester, N. Y., and the Sterling Engineering Co., Milwaukee, Wis.

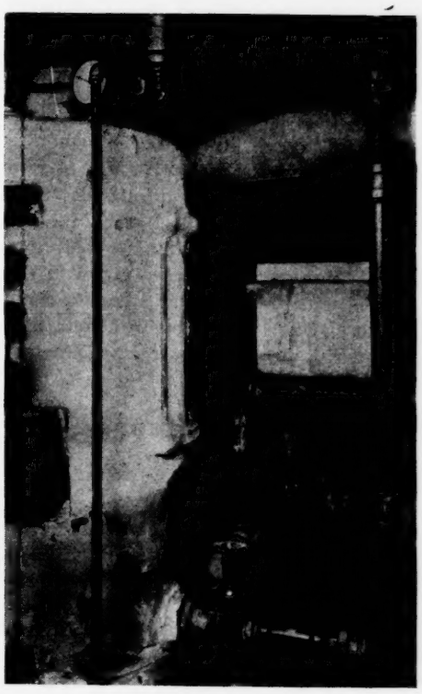
Sterling Compeller



Rochester Circulator



Janette Hydrolator



Thrush Electric Circulator

Hamilton Heads American Radiator Company

At a meeting of the board of directors of American Radiator Company, held January 28, Theodore Ahrens presented his resignation as president, and Rolland J. Hamilton, for many years vice-president and secretary of the company, was elected to fill this place. Clarence M. Woolley continues as chairman of the board of the radiator company.

At a meeting of the board of directors of the Standard Sanitary Mfg. Co., held January 31, Mr. Ahrens resigned as president and was elected to the position of chairman of the board. Henry M. Reed was elected president and chairman of the executive committee, and Theodore E. Mueller was elected first vice-president and vice-chairman of the executive committee and continues in charge of manufacturing. George Herth was elected director and vice-president and general manager of sales to fill the place of Robert E. Sargent, resigned.

It is understood that Mr. Ahrens has resigned from the presidency of both American Radiator Company and Standard Sanitary Mfg. Company that he may give more time to the affairs of American Radiator & Standard Sanitary Corporation, of which he continues as president and of which Clarence M. Woolley continues as chairman of the board.

Heating and Ventilating Supplement Makes a Hit

Copies of the International HEATING AND VENTILATING Supplement went like hot cakes during the entire period of the exhibition and proved of great service in providing a handy directory of the booths and of the representatives present for the various companies. Its forecast of the heating and ventilating business for 1930 came in for wide comment, while its stories on the future of automatic heat—coal, gas, oil and electricity—and its picture of the future of air conditioning and cooling, proved of as great interest to those directly connected with the industry as to the many visitors who were getting their first "close-up" of the industry's products.

Oil-Burner Shipments for November

November shipments of oil burners, as reported by fifty manufacturers whose output in 1927 constituted 60% of the total, amounted to 7213, as compared with 15,037 in October.

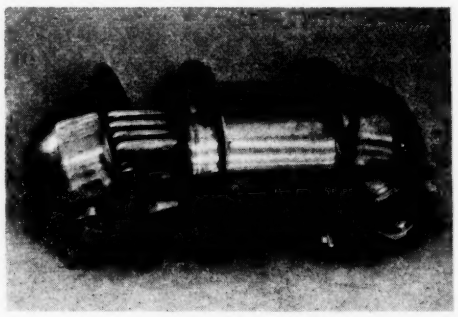
Of this total, 3867 were mechanical draft domestic stokers and 2221 were natural draft domestic stokers. The remainder were industrial type burners.

New Apparatus and Appliances

Aulbras Water Heaters

A water heater which can be attached to the side of the boiler in either a horizontal or vertical position has been announced by the Rome Brass Radiator Corp., 1 East 42nd St., New York. The device is known as the Aulbras hot water heater.

The heaters are available in 18 sizes, capacities of which range from 60 gal.



Aulbras Water Heater

to 5000 gal., with a temperature rise of 100° in 3 hrs. In size, the heaters range from 22¼ in. long x 5½ in. in diameter to 76⅝ in. long x 9 in. in diameter.

The outer casing of the Aulbras heater is made of heavy drawn sheet brass, and the headers of bronze metal. The domestic water flows through a specially designed brass unit. This is composed of from two to four sections, fastened each to the other with horizontal brass spacers, locking with nipples which are integral parts of each section.

Each section is formed of two opposing brass plates, stamped to form waterways. These plates are electrically welded. Between the brass plates at each end is a shouldered nipple. These nipples engage in the spacers between sections and are shouldered to prevent distorting the brass wall when under pressure. The sections are from 18 to 70 in. long and have two or three waterways, depending on the type of heater for which they are designed.

Skidmore Condensation Pump and Receiver

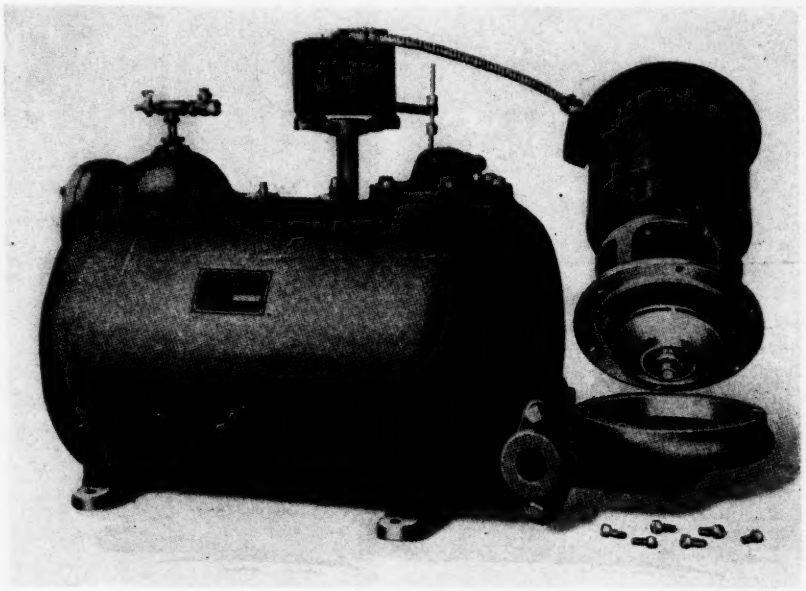
Skidmore Corp., 1535 Dayton St., Chicago, Ill., is marketing a condensation pump and receiver, the design of which has been arranged to give the lowest possible water line in the system at the time the float switch cuts in. This eliminates the necessity of placing the unit in a pit, and is due to the vertical motor construction.

The motor is supported on a rigid cast-iron volute, bolted to the end of the receiver. The float switch is mounted on top of the receiver and connected to the motor with a flexible conduit, and is operated by a seamless 5-in. copper float.

Of bronze enclosed type, the centrifugal impeller is locked on the end of the shaft against a manganese bronze sleeve which extends through the stuffing box over the shaft.

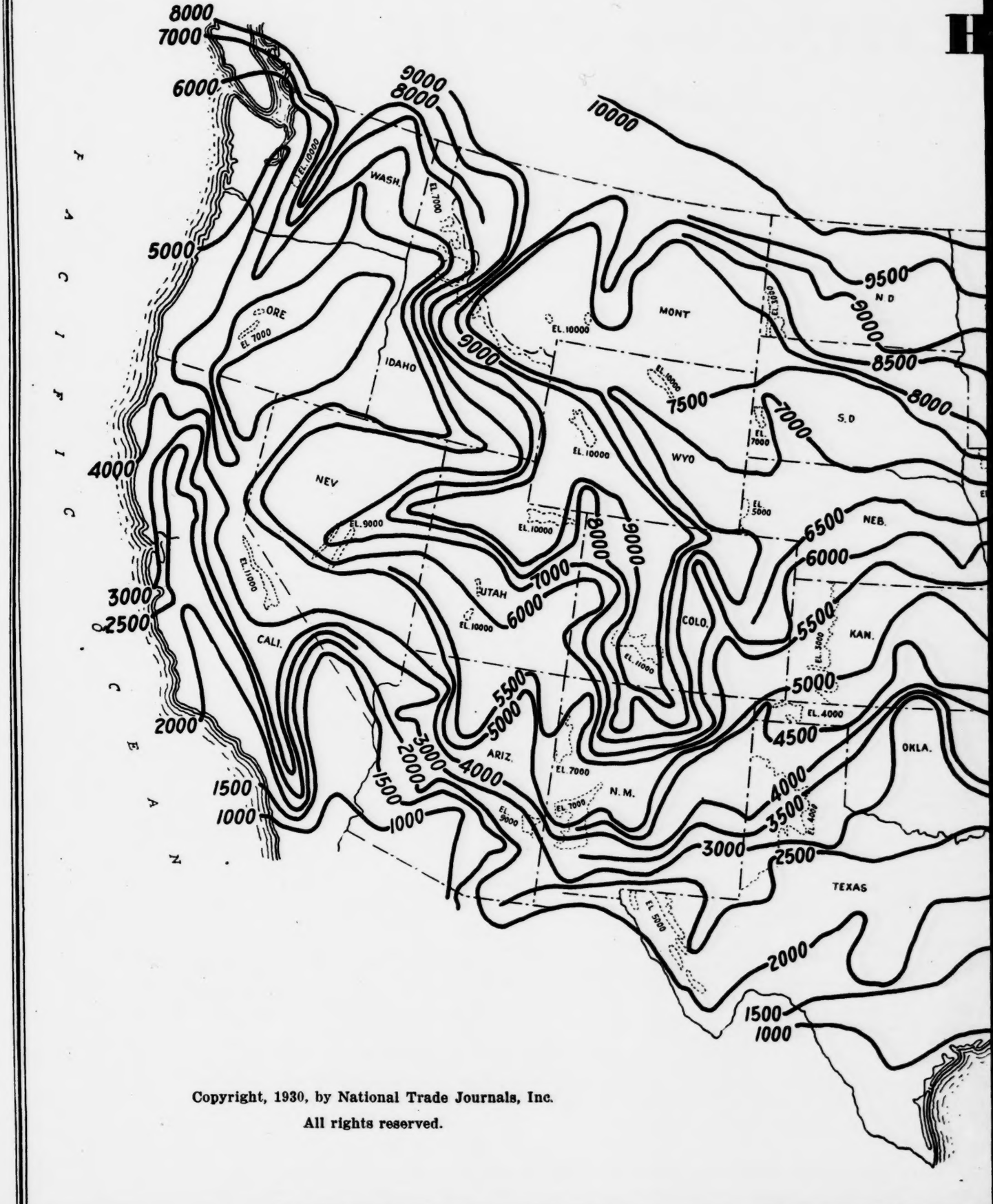
The pump provides accessibility to all working parts without disturbing the piping, and cast-iron receivers assure long life and durability.

These units are available in 18 sizes with capacities in square feet of radiation ranging from 2000 to 40,000.



Skidmore Condensation Pump and Receiver

This map shows the relative heating loads t



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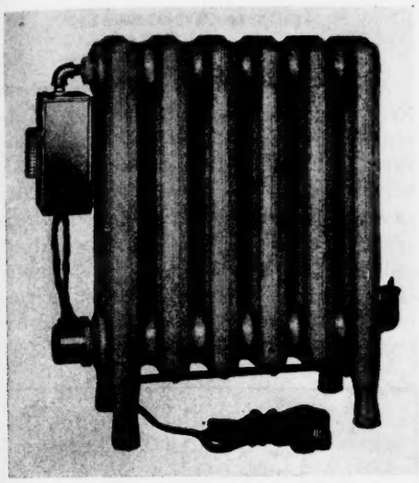
HEATING AND VENTILATING

DEGREE-DAY MAP



Automatic Electric Steam Radiator

An Electric Steam Radiating Unit

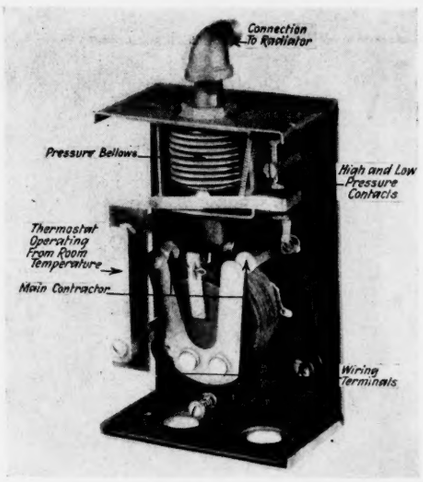
Nocare automatic electric steam radiator is announced by the Automatic Electric Steam Corp., 1 East 42nd St., New York. This unit is made up of any standard make of cast-iron or brass radiation, and has inserted in it an electric immersion element of suitable capacity with enough liquid to cover the element.

Perhaps the most interesting feature of this unit is the control. Compactly designed, the control combines a thermostatic element, high and low steam-pressure control and electrical consumption control without the use of batteries, transformers or motor generators. The control closes by temperature and opens by pressure.

To place the unit in operation, the attachment plug is inserted in the base receptacle, which causes the thermostat to close. A current then flows through the contactor coil, closing the main contactor and completing the circuit, thus energizing the heating element, which in turn heats the liquid and vaporizes it. As heat is added, the pressure increases until a point is reached, usually at 10 lbs., when the pressure control functions and cuts off the current.

The radiator is now filled with steam under pressure but no current is being consumed. As the air passes over the radiating surfaces, it absorbs the heat from the radiator, gradually diminishing the steam pressure, until a lower limit of 1 lb. is reached, when the control contact closes and current flows again. This cycle of operation continues until the room temperature reaches the point at which the thermostat is set.

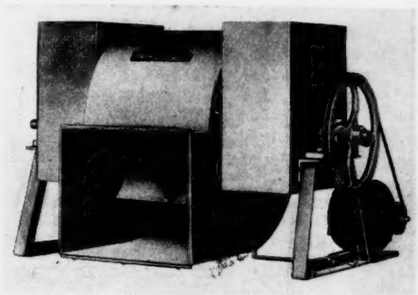
Nocare automatic electric radiators are furnished in the cast-iron pattern in sizes ranging from 10 to 25 sq. ft. radiating surface and in the light-weight welded brass pattern in sizes ranging from 12 to 35 sq. ft. of heating surface.



Control Unit for Electric Radiator

Furblo Furnace Blower

A furnace blower for use with warm-air furnace systems has been announced by the Lakeside Company, Hermansville, Mich., under the trade name of Furblo.



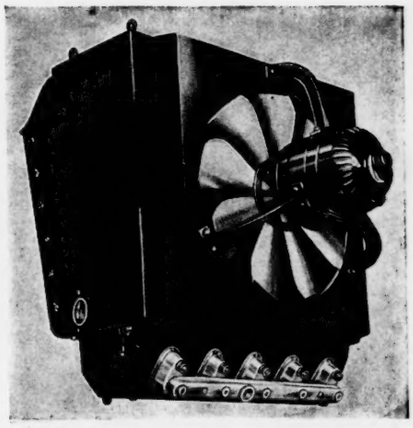
Furblo Furnace Blower

The unit is quiet in operation, the blower and motor being anchored to the floor and not to the furnace or cold air returns. Air is forced from the blower by a series of backwardly curved blades, which run at low speed. The cold air return from the rooms is connected to the large rectangular chambers shown at either sides of the blower in the illustration. The unit is available in two different sizes, but for required capacities different size motor pulleys can be furnished, making, in effect, 15 capacities. These range from a free delivery of 900 to 3890 cu. ft. per min.

Columbus Gas-Fired Unit Heater

A gas-fired industrial unit heater, No. 150, has been announced by the Columbus Heating & Ventilating Co., 400 Dublin Ave., Columbus, O.

It is designed for ceiling or truss suspension, and is controlled by a Mercoid thermostat. In addition, it is equipped with an automatic safety device to shut off the gas if the pilot becomes extinguished or the electric service interrupted.



Columbus Gas-Fired Unit Heater

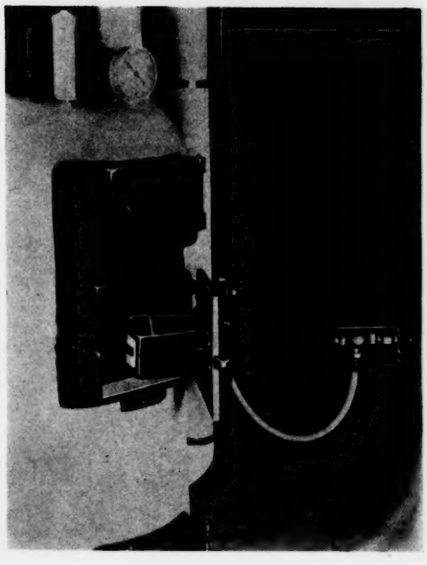
Gas is burned inside a cast-iron combustion chamber, and the products of combustion pass upward through a series of brass tubes, which connect the top of the combustion chamber to the header-radiators at the top of the heater, and from thence pass to the fume outlet at the top of the unit. The heated air is directed to the working zone by adjustable deflectors.

The housing is of heavy sheet steel, so as to reduce vibration. Burners are of cast-iron sectional type of one piece construction. The thermostat has an adjustable range from minus 10° to 130°F. The unit has a capacity of 150,000 B.T.U. per hr., with an air delivery of 2400 cu. ft. per min.

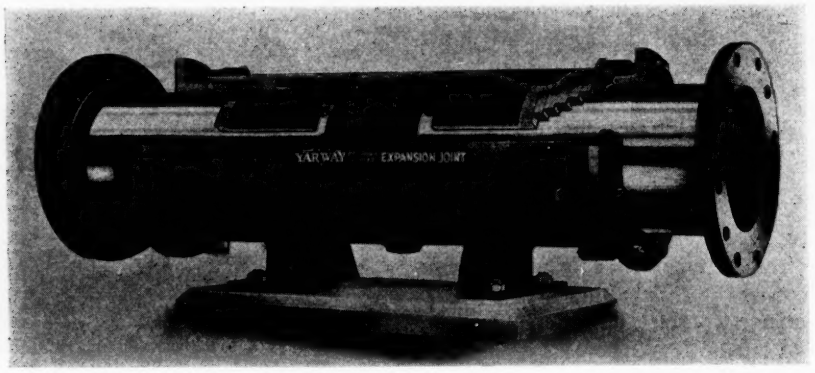
Door Conversion Burner

An inexpensive gas conversion burner is being marketed by the Door Burner Corp., Brisbane Bldg., Buffalo, N. Y., for burning natural, artificial or mixed gas in existing coal boilers. It has a capacity of 150 cu. ft. of gas per hr.

The burner is of the direct high velocity type, and operates without secondary air supply.



Door Conversion Burner



Yarway Expansion Joint

Expansion Joint for High and Low Pressure Lines

Designed for use in conduits, manholes and inaccessible locations in general, the Yarway cylinder guided expansion joint has been placed on the market by the Yarnall-Waring Co., Philadelphia, Pa. Among the features of the joint are a cylinder guided, chromium covered steel sliding sleeve, a diameter smaller than that of the pipe flange, a large, deep stuffing box and an easily accessible packing gland.

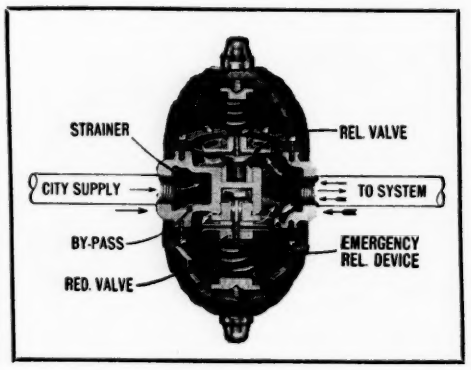
The construction of the joint is such that the sleeve slides through the packing gland with the least possible friction. It is held in positive alignment by the guide which is a part of the packing box body. The hot liquid or vapor, completely surrounding the guide, causes it to expand equally with the sleeve, and overcomes sticking and wear. The sleeve is placed well away from the inside bottom of body, so that foreign material can drop into a dirt pocket, eliminating cutting and resulting in longer life of the packing.

Yarway Joints are furnished in double types with base, and in single types both with and without base, in all sizes.

D. & T. Relief Valve

An All-In-One valve is being marketed by the D. & T. Mfg. Co., 3001 La Salle St., St. Louis, Mo., for water heating systems. The valve operates automatically without an expansion tank, and contains in one unit a reducing valve, a relief valve and strainer.

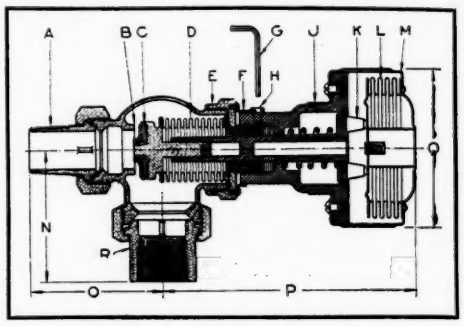
The reducing valve maintains 10 lb. pressure in the system, and the relief valve eliminates the pressure higher than 30 lbs. All parts exposed to water are of phosphorus bronze and non-corrosive materials.



All-In-One Valve

Sylphon Automatic Radiator Valve

An automatic radiator valve, Sylphon No. 875, has been announced by the Fulton Sylphon Co., Knoxville, Tenn. The valve is a combination packless radiator valve and temperature control unit, suitable for any two-pipe steam heating system utilizing either floor or ceiling radiators. The valve operates automatically when there is a variation in the room temperature, and automatically regulates flow of steam to the radiator.

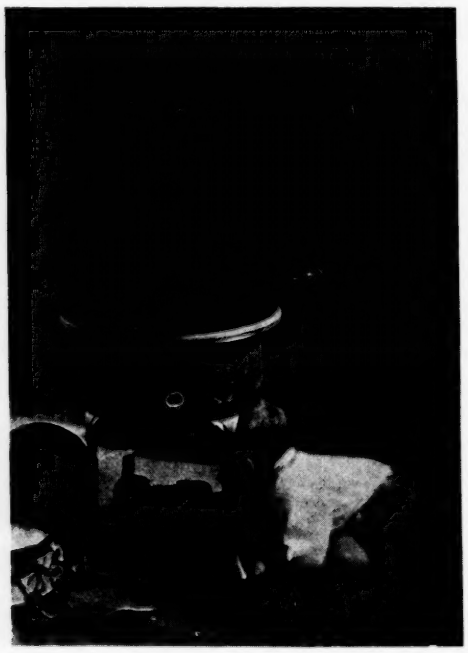


Sectional View of Fulton Radiator Valve

The thermostatic element "L" is made from a Sylphon bellows which develops sufficient power to close the valve tightly without undue increase of temperature in the room. The thermostatic element is responsive only to the temperature of the air surrounding it, and is not influenced by the temperature of the steam pipe or the radiator.

By rotating the thermostatic head "M," just as one would turn an ordinary radiator valve handle, different temperatures are obtained. The bakelite portion "J" is provided with markings "hot," "medium," "cold" and "shut."

These valves can be supplied in sizes ½ in. to 1½ in.

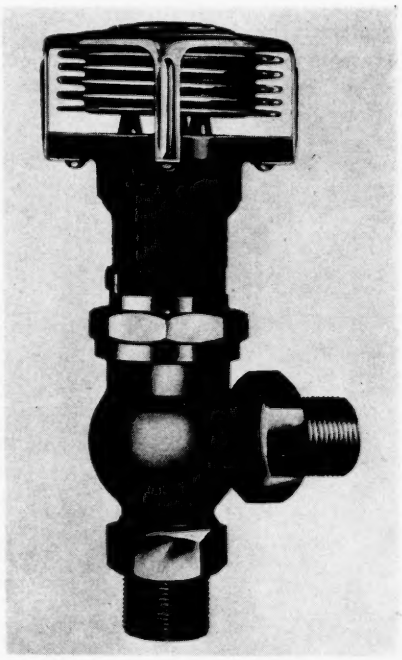


Hoffman Thermador

Thermador Electric Heater

Combining an electric heater with an attractive occasional table, the Thermador has been announced by the Hoffman Specialty Co., Inc., Waterbury, Conn. It is equipped with a motor-driven fan which delivers a quantity of heated air in a horizontal direction. Some of this warm air rises, but the action of the fan is such that the greater part of the heated air is drawn back toward the floor, resulting in maintaining a temperature at the proper point in the living zone of the room. The fan can also be kept in operation in the summer to maintain a circulation of unheated air.

The Thermador is finished in neutral tones of dark crinkled brown to harmonize with the furnishings of any room. It is available in three sizes, with capacities of 1250, 2500 and 4000 watts. The heights of the three units are 11⅜ in., 13¾ in. and 21.



Sylphon Automatic Radiator Valve

Thico Humidifier

For application in connection with steam, vacuum and vapor heating systems, the Thico humidifier has been announced by the Thico Co., 5936 Grand Central Terminal, New York.

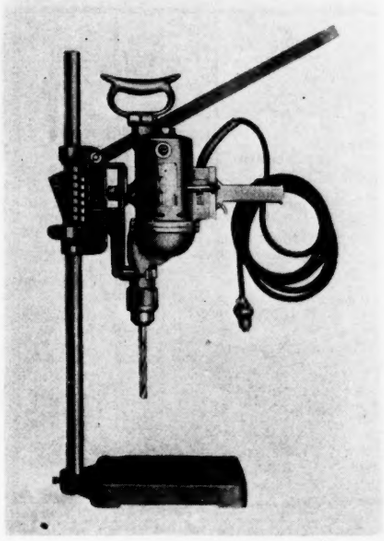
An evaporating chamber is placed beneath the radiator below the joist supporting the floor around the steam branch connected to the radiator. Steam flowing through the branch keeps the water in the humidifier to a point near the temperature of the steam itself. As the water in the humidifier becomes hot, the stack draft induced in the vapor tube, which extends between the columns of the radiator into the room, draws the vapor into the room. The humidifier has a capacity of 1½ to 2 lb. of water per hr.

Wodack All Purpose Drill

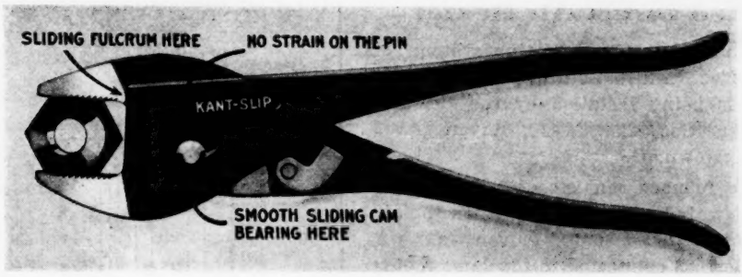
The Wodack all purpose portable electric drill, is announced by the Wodack Electric Tool Corp., 4627 West Huron St., Chicago. It combines lightness with power and performs in an unlimited range of drilling requirements.

A General Electric motor of ample reserve power is built in for direct or alternating current of 60 cycles or less, 110-125 or 220-250 volts as desired. An oversize double pole, trigger switch in convenient position, insures long life. High grade ball and roller bearings are used, the heavy thrust loads being carried by Timken roller bearings. Hardened gears are simply assembled, grease compartments are designed for long periods of operation, and correct ventilation is provided for by an oversize fan for quick cooling during idle running.

Capacities are to ⅝ in. in steel and 2 in. in wood.



Wodack Portable Drill With Stand

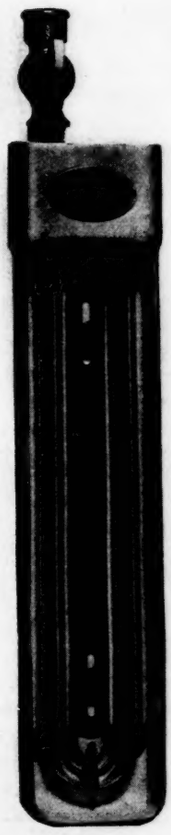


Kant-Slip Plier

Kant-Slip Plier

A plier in which the pin is not utilized to take the strain but merely to hold the parts together, has been announced by the Kant Slip Plier and Tool Co., 6036 Wentworth Ave., Chicago. The cam slides the fulcrum to its correct position, irrespective of the load, the sliding action of both the cam and the fulcrum combining to wedge the work between the jaws.

Round, square, hexagonal, or objects of any other shape are held without slipping. The plier is made of drop-forged alloy chrome vanadium steel.



Manometer with Large Bore

Meriam Manometer

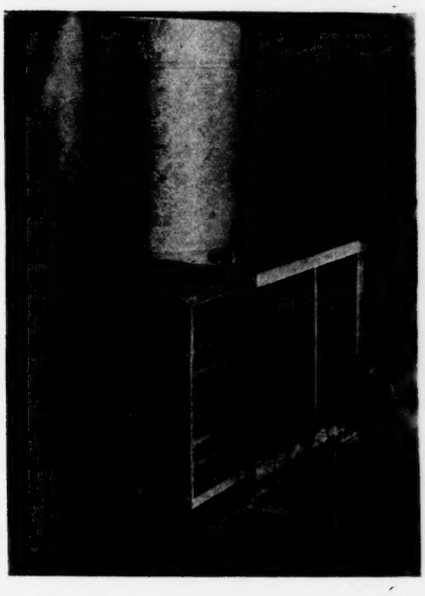
With a view to overcoming the difficulty so often met with in filling the tubes of manometers, the Meriam Co., 1955 West 112th Street, Cleveland, O., has recently placed on the market a specially designed manometer with a larger bore of tube than that generally employed.

This not only makes it easy to introduce the measuring liquid but also facilitates the disengagement of air-bubbles, which would affect the accuracy of the readings—an especially important matter when measuring the flow of larger volumes of liquids or gases at low pressures; for such cases, of course, a slight error in the difference between the levels in the two legs of the U-tube might result in a decided error in the rate of flow.

Korectaire Conditioning Unit

A humidifying and cleaning unit is combined with a fan for forced circulation in the Korectaire air-conditioning unit for application to warm-air furnace systems. This unit was recently announced by the Watt Mfg. Co., Sterling, Ill. The motor is waterproof, is provided with motor bearings and is mounted on sponge rubber plates, thereby eliminating vibration and noise.

The unit is available in three types, with capacities ranging from 950 to 1750 C. F. M.



Watt Mfg. Company Korectaire Unit

Lee Direct Air Heater

A heating and ventilating system for factories, mills, auditoriums, garages, etc., is being installed by the Lee Air Heater Co., 222 West Rayen Ave., Youngstown, O.

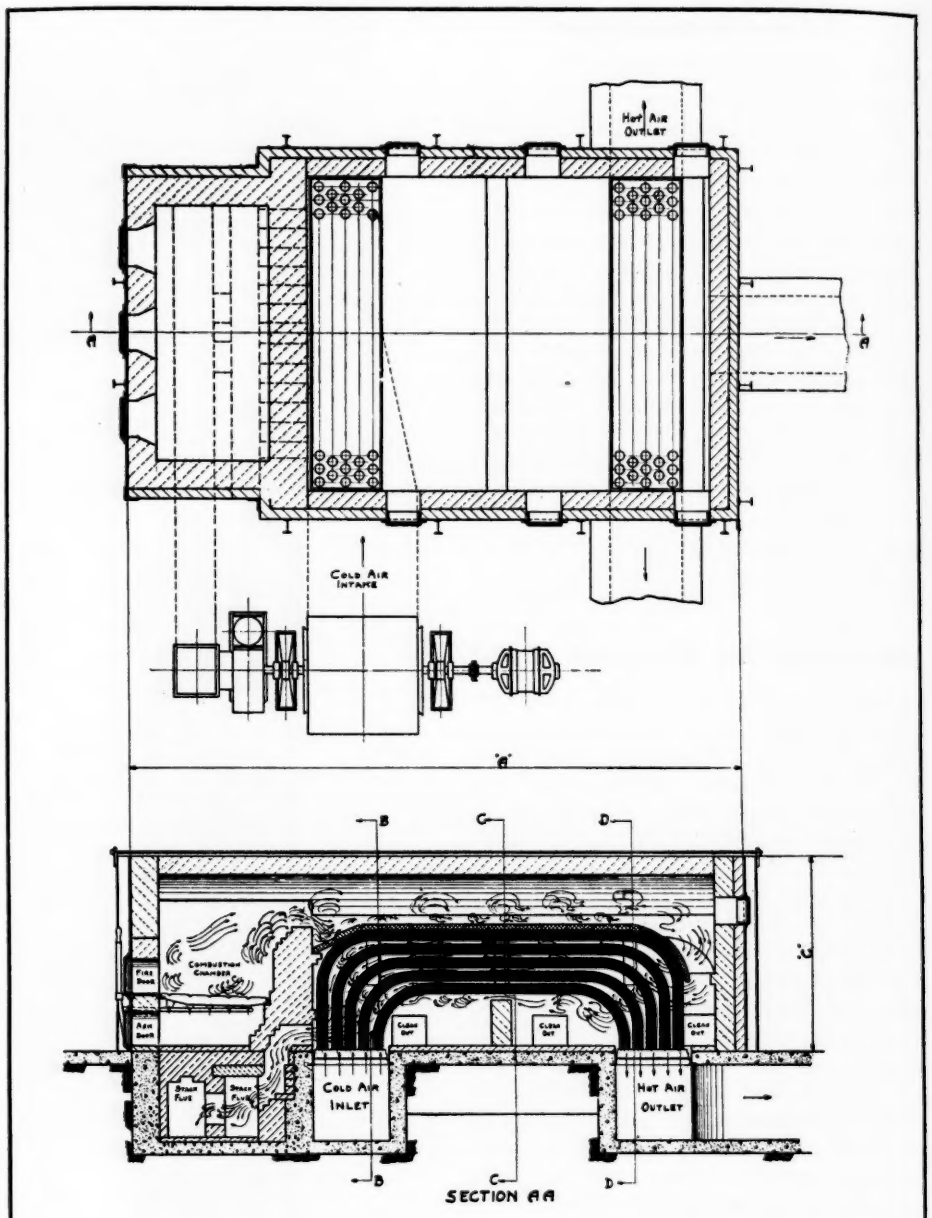
The furnace consists of a direct-fired tubular air heater through which the air is blown by a motor-driven fan. A smaller fan connected to the same motor delivers the products of combustion to the stack. The heater and fans are enclosed, either in a separate room or in a sheet metal casing, in such a manner that the air to be heated passes first over the outside of the furnace, recovering any heat lost by radiation. Where permissible, the air is recirculated, but in garages and similar buildings, cold air from the outside is brought in.

Heated air from the furnace is distributed to the buildings by overhead or underground ducts with outlets at those points where warmth is needed. The air outlets may be mushrooms on the floor, or ducts may be led alongside walls and columns to discharge the air at 6 or 7 ft. above the floor.

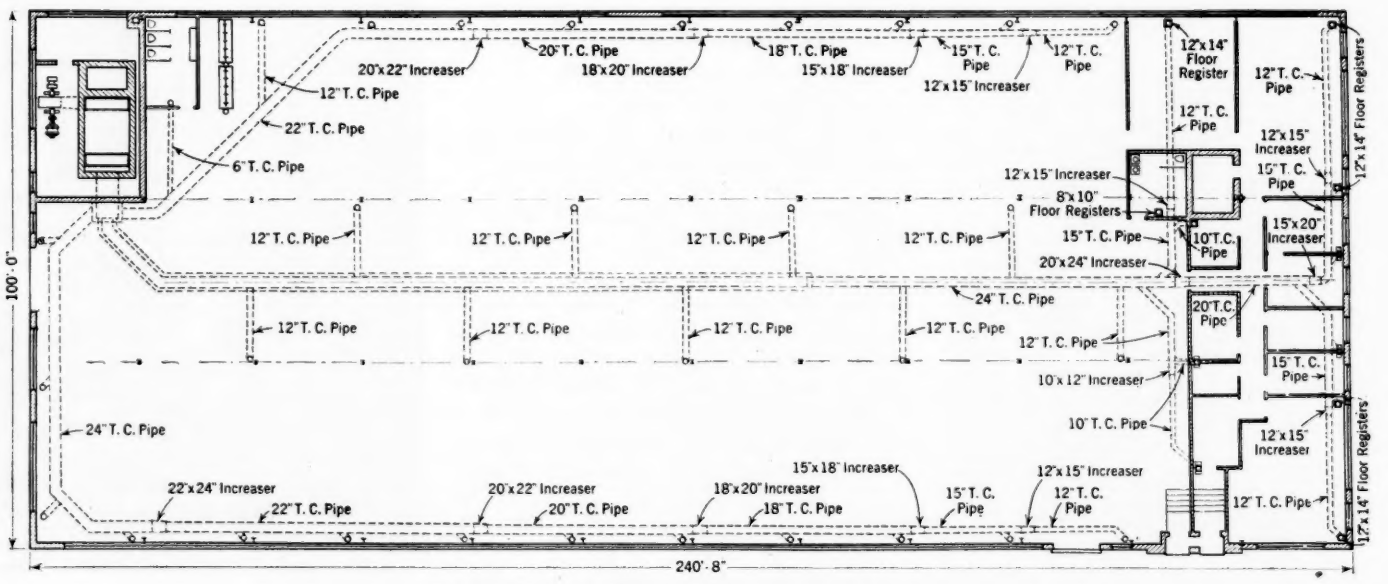
As there is no condensation to be returned, the heater is commonly installed at floor level, either in the building itself or in a leanto at one side. No cellar or pit is required.

The heater is of heavy fire brick construction throughout, the combustion chamber being constructed so that the flames cannot play against the tubes directly. The tubes are bent to shape so that expansion and contraction do not throw any strain upon the furnace or supporting members.

Tests made by Prof. A. H. Blaisdell, of the Carnegie Institute of Technology, show an efficiency of 80% in the installation as a whole.



Plan and Section of Lee Air Heater

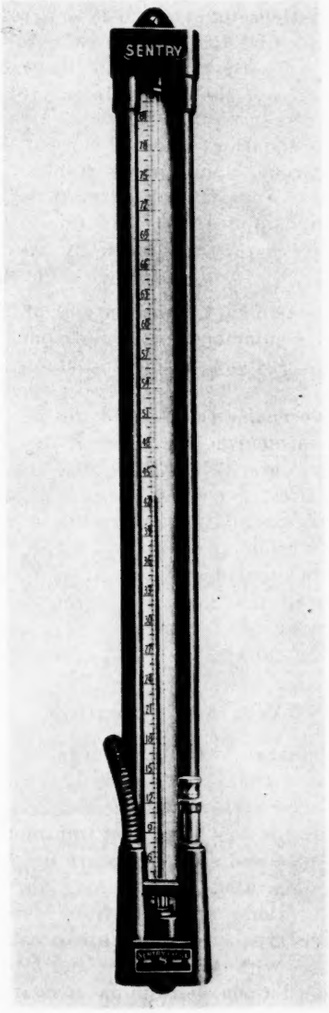


Duct Layout of Lee System in Plant of Hertner Electric Company, Cleveland

Sentry Gauges for Oil Storage Tanks

A direct-reading gauge for indicating the amount of oil in the storage tank is being sold by the Water Works Supply Co., 501 Howard St., San Francisco, under the name of the Sentry liquid level gauge. The frame is of cast aluminum, finished with baked enamel, while the top and fountain, or bottom piece, are of cast brass. The top acts as an emergency chamber to receive the gauge fluid in case of overfilling of tank or excessive pumping.

One single line of continuous tubing connects the gauge to the tank. Air cannot leak out of the gauge and affect the accuracy of the reading, nor can the gauge fluid be forced out of the gauge and render it useless. The bottom casting or fountain carries the pump and provides a compression chamber and reservoir for the gauge fluid. The pump is used to reset the gauge after each filling of the tank or can be operated to check the reading at any time.



Sentry Oil Gauge

New Trade Publications

Welding

Pipe Welding with Stock Fittings in the New Power Plant at the Bureau of Standards, Washington, D. C., is the title of bulletin No. 105, published by Tube-Turns Inc., Louisville, Ky. The bulletin describes and illustrates the use of Tube-Turns in welded piping in a particular installation. Plans of the new power plant are shown, together with tables of specifications for standard stock sizes of Tube-Turns.

Torchweld Welding and Cutting Equipment is featured in a catalog issued by the Torchweld Equipment Co., 224 No. Carpenter St., Chicago, Ill. Large sectional views, together with text pointing out the particular features of the Torchweld welding torch, cutting torch, and regulator are included. The material is listed under the various headings of welding equipment, cutting equipment, cutting units, cutting units and torches, and regulators. Size 8½ in. x 11 in. Pp. 39.

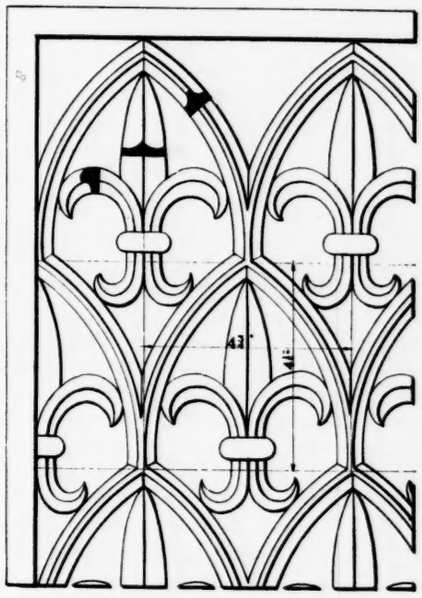
Welding and Cutting Nomenclature, Definitions and Symbols. American Welding Society, 33 West 39th St., New York. This bulletin has been under preparation by the American Welding Society for the past three years. It is divided into four sections, covering nomenclature; definitions of general welding terms, processes, forms of joints, forms of welds, and equipment and supplies; abbreviations, and symbols. Under nomenclature the names of the principal welding processes are given and there is a schematic diagram of the processes illustrating their interrelation. The definitions in Section 2 and abbreviations in Section 3 are profusely illustrated so that there can be no misunderstanding of what is meant. The symbols in Section 4 are for use in connection with the resistance and fusion welding processes. The standards will be an invaluable aid to engineers, designers, contractors, welding foremen and all persons using any of the welding processes.

Copies of the bulletin can be obtained from the society. Price, 50c. Pp. 43.

Fabrication of Welded Piping Designs. The second booklet on design standards published by the Linde Air Products Co., 30 East 42nd St., New York, for the use of the executive, welder foreman and welder, to enable them to apply successfully the fundamental designs described in the first booklet, Standards for Oxwelded Steel and Wrought-Iron Piping. The booklet, which is divided into three sections, contains procedure controls for line joints and fittings, templet layout for pipe fittings, and tables for estimating cost. Many detailed diagrams and drawings are included, together with tables for laying out templets. Size 6 in. x 9 in. Pp. 86.

Grilles

Perforated and Cast Newman Grilles. The Newman Mfg. Co., Cincinnati, O. The booklet contains numerous examples of unusually attractive designs of grilles for ventilating and heating installations. Illustrations and descriptions of standard styles are included, together with tables of unit sizes and dimensions. Size 7¾ in. x 10¾ in. Pp. 40.



Detail of a Newman Grille

Meters

Why You Should Use Flow Meters is told in a booklet published by the Brown Instrument Co., Wayne and Roberts Aves., Philadelphia, Pa. Among the numerous chapters included are those headed, "24 Ways in Which Flow Meters Reduce Steam Costs," Holding Down Steam Plant Investment," "Increasing Boiler Operating Safety," "Detecting Transmission Line Leaks," "Stopping Costly Radiation Losses," and "Simplifying Economy in Heating Buildings." Each chapter includes an illustration of an actual installation, relating to that subject. Size 8 in. x 10½ in. Pp. 32.

Ventilation

Industrial Daylighting by the Fenestra Method and **Industrial Airation** by the Fenestra Method. Detroit Steel Products Co., 2250 East Grand Boulevard, Detroit, Mich. These books contain a non-technical description of the methods used to predetermine the daylighting and airation of industrial buildings in advance of construction. This information which is based on seven years of experimental work by company engineers in cooperation with the Department of Engineering Research of the University of Michigan, will prove of value to architects, engineers, plant owners, executives, maintenance and production engineers.

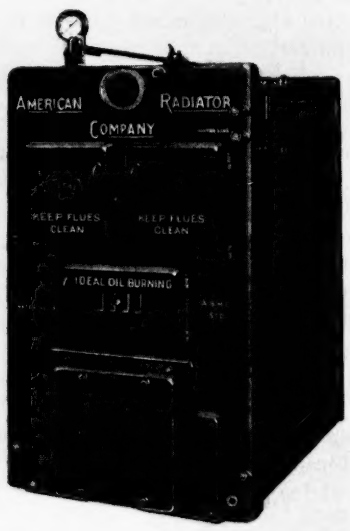
The material in each booklet is divided into 18 subjects, among which are, "How to Get Evenly Distributed Daylight," "What is Considered Good Ventilation," "Temperature Difference as a Means of Moving Air," and "How Should a Building be Designed for Airation." Each, size 8½ in. x 11 in. Pp. 24.

Boilers

Newport Magazine Feed Boilers appears on the cover of a special portfolio containing a complete set of advertising literature of the Newport Boiler Co., Chicago, Ill. The portfolio is designed for the use of the salesman or contractor in dealing with the consumer. Among the literature included are booklets or folders "Keeping Warm in Weston Park", "And They Lived Happily Ever After", "Confessions of a Coal Shovel", "Newport Boilers Cut Fuel Bills 30 to 50%", "Warm Comfort All Winter Long", "Comfort Costs Less with a Newport! Our Architect Was Right", "Reduce Your Fuel Cost 30% to 50%", "There is Only One Right Way to Fire Your Boiler." There are also selling tips for the salesman, a special booklet on Newport oil-burning boilers, an alternate proposal form, and a letter from the Department of Inspection of the New York Life Insurance Co., in which the superintendent of the department endorses the boiler. The folders, bulletins and catalogs are attractively colored, and are a valuable addition to the selling equipment of a contractor who handles this line of boilers.

Bryan Oil or Gas Burning Copper Tube Boilers are the subject of catalog No. B5 published by the Bryan Steam Corp., Boiler Division, Peru, Ind. The construction of the boilers is described in detail, together with illustrations of the oil-fired and gas-fired models, and diagrams showing a hook-up for Summer domestic hot water, a typical hot water storage system, the fuel waste in ordinary boilers, and the fuel saving with Bryan boilers. Chapters on water circulation, heat loss through large flues of ordinary boilers, requirements of a perfect steam boiler, and advantages of Bryan boilers are included, together with consumption, capacity, radiation and fuel estimating tables. Size 6 in. x 9¼ in. Pp. 47.

Ideal Oil-Burning Boilers. American Radiator Co., New York. This booklet describes a line of cast-iron sectional boilers designed exclusively for burning oil.



Ideal Oil-Burning Boiler

The boilers are available with 23 in., 29 in. and 36 in. grates, in a total of 25 sizes, with capacities ranging from 1200 to 9600 sq. ft. of steam radiation.

61 Years of Progress in Steel Boiler Building is the subject of a booklet issued by the Kewanee Boiler Corp., Kewanee, Ill. The progress of this company during its 61 years of existence is outlined, together with interesting illustrations of boilers manufactured from 1868 to the present day.

Lansdale-Craig Water Tube Heating Boilers are the subject of a catalog issued by the Central Radiator Co., 420 Lexington Ave., New York. The advantages and features of these sectional boilers, which can be supplied in capacities ranging from 350 to 6950 sq. ft. of steam radiation, are explained in detail. Performance tables based on tests made by the Frost Research Laboratory are presented for each of the sizes listed. Size 8½ in. x 11 in. Pp. 12.

Let The Gray Sentry Protect Your Home Against Winter is the title of a consumer booklet received from the Central Radiator Co., 420 Lexington Ave., New York, containing a description and a cutaway view of these jacketed boilers, together with data obtained in tests made by the Frost Research Laboratory.

Oswego Internally Fired Water Tube Boilers are the subject of bulletin No. 2, received from the A. D. Granger Co., 15 Park Row, New York. Sectional views of the boilers, illustrations and descriptions of the various parts of which they are made are presented. Many buildings are shown in which the Oswego boilers are installed. Size 8 in. x 10½ in. Pp. 20.

Air Conditioning

Baffle-Whirl Cooling Towers are described in circular No. F issued by the Zanesville Engineering Corp., Zanesville, O. A table listing capacities and dimensions of the various models, together with an illustration of a tower, a diagram of the optional header and of an optional pump installation, are included.

Electrical Equipment

Wagner Squirrel-Cage Motors are featured in bulletin No. 165 distributed by the Wagner Electric Corp., 6400 Plymouth Ave., St. Louis, Mo. The bulletin contains discussions of cost, performance, and delivery, as well as descriptions of standard squirrel-cage motors, high-torque across-the-line motors, low-torque across-the-line motors, etc. One of the interesting features of the bulletin is table 7, which tabulates the designation, starting current, starting torque, approximate full-load slip, ratings, mechanical variations and typical applications of the various squirrel-cage motors made by this company. Size 8 in. x 10½ in. Pp. 22.

Selection and Application of Electrical Equipment for heating and ventilating systems is the subject of a bulletin (A.I.A. File No. 31g1) issued by the Westinghouse Electric and Mfg. Co., East Pittsburgh, Pa. Among the topics covered are types of fans, load characteristics, types of motors, types of drives, installation, power factor and consumption, and types of control. Much valuable technical information is to be found in tables, charts, formulae, and diagrams, in typical Westinghouse fashion. Size 8½ in. by 10½ in. Pp. 11.

Warm-Air Heating

Follansbee Warm-Air Furnaces. Follansbee Brothers Co., Pittsburgh, Pa. The various Follansbee furnaces, including the cast iron, cast iron pipeless, three-pipe and steel types are described and illustrated in Catalog No. 29F. Specifications and important features of each type of furnace are presented, together with Articles 1, 2 and 3 of the Standard Code, pertaining to warm-air heating systems. Size 8 in. x 11 in. Pp. 28.

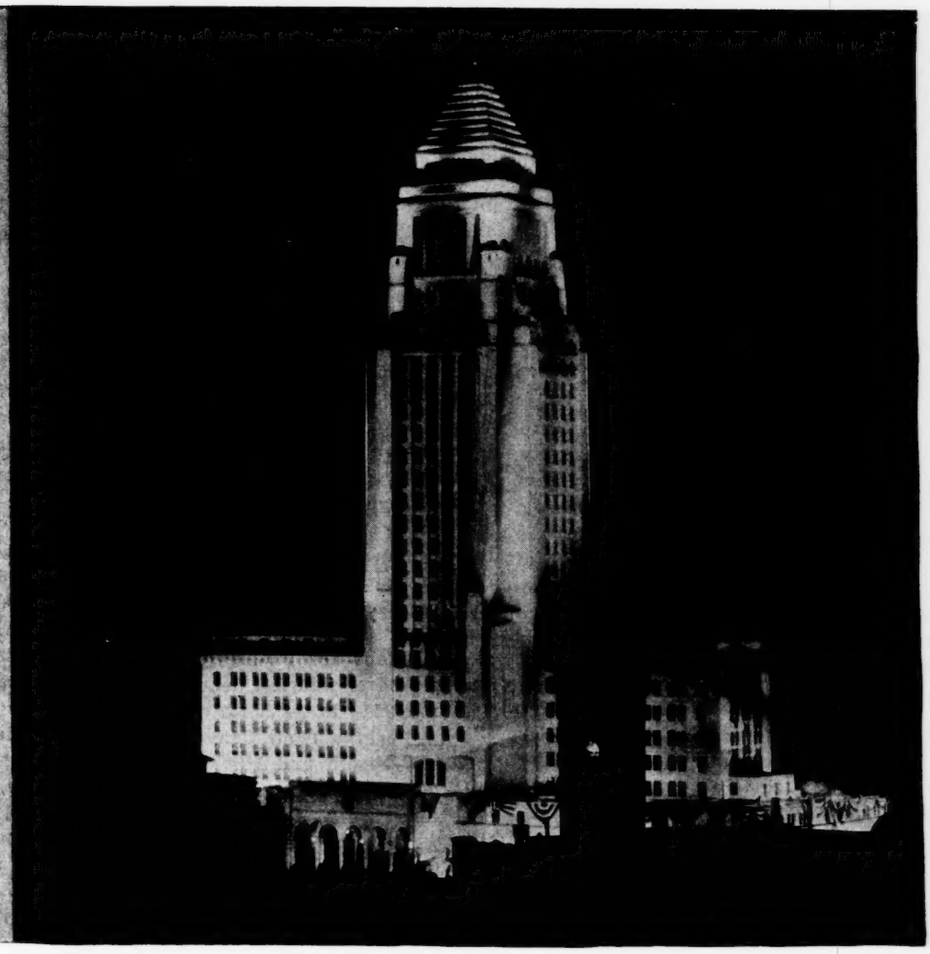
LOS ANGELES CITY HALL

• • •

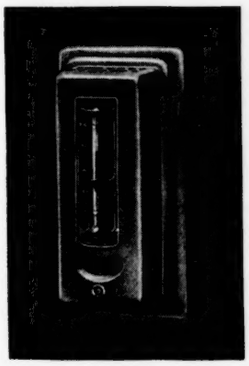
Architects:
Austin, Marten, & Parkinson

Engineers:
Holmes & Sanborne

Contractors:
Lohman Bros.



POWERS



Powers Thermostats Are Better

Because—they need no annual adjustments or overhauling—have no fine restrictions to become clogged by dirt—are no larger than others, but thermostatic element is larger—therefore more sensitive and powerful.

ANOTHER prominent building equipped with Powers Automatic Temperature Control is the Los Angeles City Hall. Powers control usually costs more—it is worth more—because of its long service without repairs, and because of the frequent inspections we make to insure exact control at all times. This SERVICE continues throughout the life of the building and the user gets the largest possible return on his investment in heat control.

THE POWERS REGULATOR COMPANY

35 Years of Specialization in Temperature Control

CHICAGO: 2718 Greenview Avenue NEW YORK CITY: 137 East 46th Street

Offices in 35 Other Cities

The Canadian Powers Regulator Company, Toronto, Ontario

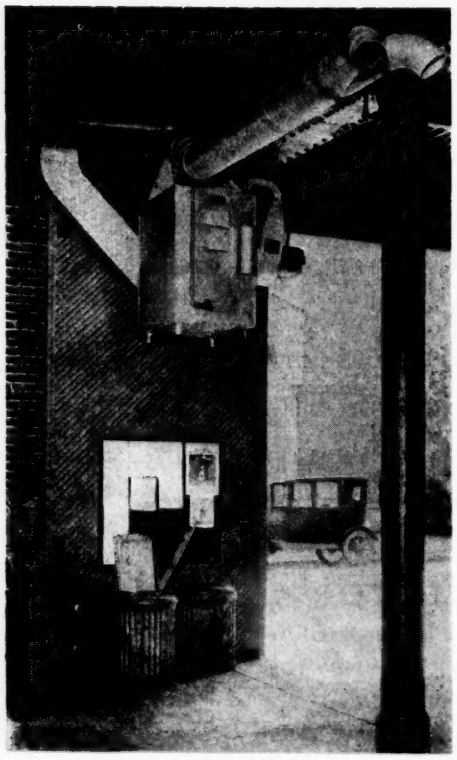
Traps

Condensate. W. B. Connor Co., Inc., 369 Lexington Ave., New York. This booklet tells owners and executives what condensate is, its value, and how its conservation is effected. The subject is treated in a non-technical manner, yet will prove of interest and value to plant superintendents, operating engineers, and those connected with plant equipment. Many illustrations, detailed diagrams and tables are included. Size 8½ in. x 11 in. Pp. 38.

Gas Heating

Autogas Automatic Gas Burner. Autogas Corp., 2258 Diversey Parkway, Chicago. Interesting chapters on radiant and convected heat, cost of gas heating, and the operation of the burner are included, together with photographs of typical installations, letters of commendation from home owners, and a capacity and specification chart. Size 8½ in. x 11 in. Pp. 18.

The Most Efficient Central-Heating System in the World! General Iron Works Co., Cincinnati, O. This booklet features the Hot-Kold suspended and floor-type gas-fired furnaces. The suspended type is so designed that it can be hung from or placed on roof trusses. Numerous illustrations are included showing private and industrial buildings in which these units are installed, together with letters of commendation from the owners, architects and engineers, a chapter on the estimating of gas consumption, and the story of Hot-Kold performance. Size 8½ in. x 11 in. Pp. 30.



Hot-Kold Unit

I Can Reduce Your Gas Bill is the promise appearing on the cover of a catalog published by the Lee B. Mettler Co., 406 S. Main St., Los Angeles, Calif. Detailed illustrations of the various parts of the Mettler gas burner unit are presented, together with diagrams of typical combustion chamber arrangements, typical installations, and tables of capacities. Size 8½ in. x 11 in. Pp. 23.

Radiation

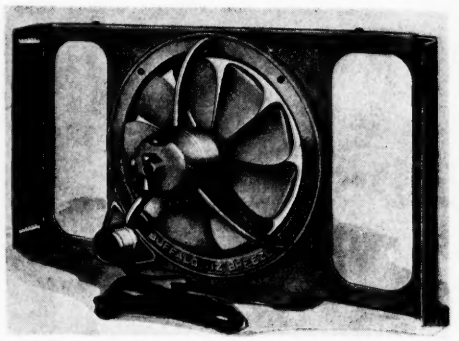
Putting the B.T.U. to Work is the title of a booklet received from the J. C. Black Mfg. Co., Inc., Oil City, Pa., in which the Pioneer complete concealed heaters are described. Illustrations of various types of heating units are included, together with numerous tables and two graphs made from laboratory tests conducted by the company are compiled so as to make it easy to determine the size of element to use. Formulas for figuring radiation under all conditions are given, together with the method of figuring heat loss. Size 8¼ in. x 11½ in. Pp. 23.

Shaw-Perkins High Convection Radiators for Steam and Hot Water Heating, Cooling, Drying and Industrial Applications are the subject of catalog No. 30 received from the Shaw-Perkins Mfg. Co., Pittsburgh, Pa. The booklet describes three new models in the high convection type which are known as ceiling radiators, but which have a variety of applications. Illustrations of the models in various installations are included, and many buildings in which they are used are shown. Tables are presented of specifications for the six models of these radiators for ceiling, column, wall or floor, steam or water installations; radiator heat emission, radiator capacities in vertical and recessed installations, coefficients of heat transmission, together with diagrams of radiator measurements. Size 7 in. x 10 in. Pp. 32.

Proof of the Pudding is the title of an unusually attractive booklet published by the Rome Brass Radiator Corp., 1 East 42nd St., New York. The booklet contains illustrations of the Robras radiator in various sizes, and the parts of which it is composed, but is mainly taken up with illustrations of typical buildings and rooms in which these radiators are installed. A short paragraph under each illustration is included, describing that particular installation. Size 8½ in. x 10½ in. Pp. 24.

Fans and Blowers

Kitchen Comfort— and an Odorless House, the title of a consumer's folder received from the Buffalo Forge Co., Buffalo, N. Y., is devoted to the new glass-panel Breezo home ventilating fan. The panel is made in two sizes, one to



Glass Panel Breezo Fan

fit windows from 26 in. to 36 in. wide, the larger for 36 in. to 46 in. windows.

Charavay Exhaust Ventilating Fan and Blowers. Hartzell Propeller Fan Co., Piqua, O. Charavay blowers and single-propeller, two-propeller, and multi-blade types of fans are featured. Detailed diagrams and tables of capacity, dimension, and area and circumference of circles are included. Size 8¾ in. x 11½ in. Pp. 31.

Catalog No. 55, containing descriptions and illustrations of the full line of blacksmith forges, toolmakers' and boilermakers' forges, post drills, power drills, power hammers, bench grinders, saws, screw plates, taps and dies, and thread cutting machinery has been issued by the Champion Blower & Forge Co., Lancaster, Pa. Descriptions of the Champion steel pressure blower, power blower, fan blower and exhaust blowers also are included. Size 8½ in. x 11 in. Pp. 136.

Stokers

Brownell Type A1 Underfeed Stoker is featured in catalog S-51 issued by the Brownell Co., Dayton, O. The booklet contains illustrations of installations, descriptions of details of construction of the stoker, and shows a reproduction of steam pressure charts using hand-firing and firing with stoker. Size 8½ in. x 11 in. Pp. 12.

Pipe

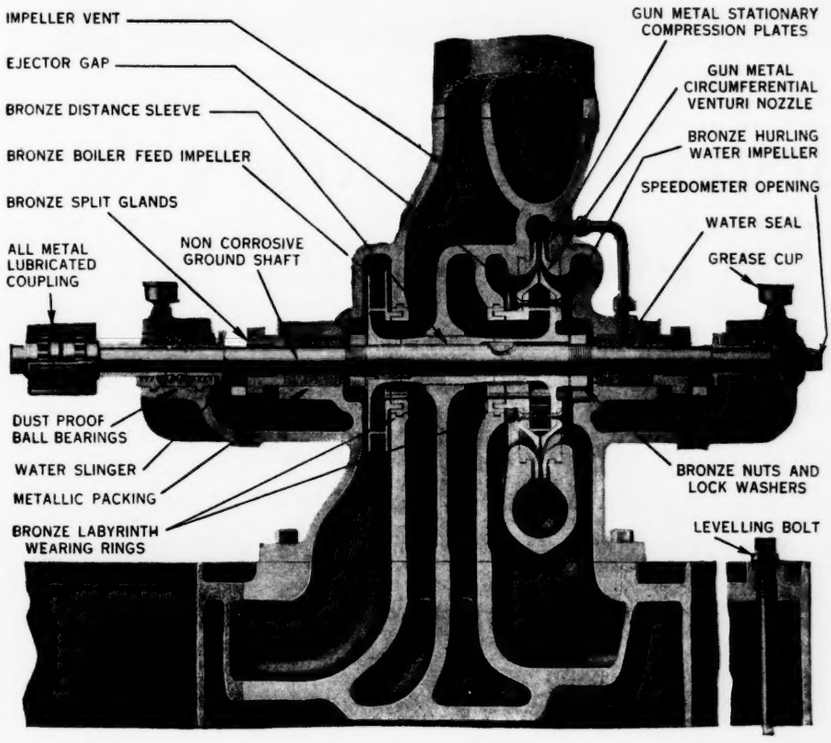
Beaver Grooving Tools for Use with "Victaulic" Joints. Bulletin G from the Borden Co., Warren, O., describes and illustrates the advantages and features of five different models, together with a table of list prices.

Heating Systems

Hoffman Heating Equipment. Hoffman Specialty Co., Inc., Waterbury, Conn. This booklet which is divided in three parts, contains specifications and complete information on venting valves, controlled heat equipment, miscellaneous valves, vacuum, condensation and air line vacuum pumps, and moto-heaters. Tables of capacities are included, together with numerous illustrations and diagrams of the devices. Size 8½ in. x 11 in. Pp. 57.

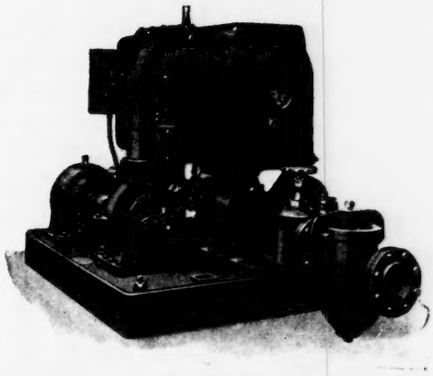
AMES
VACUUM HEATING PUMP

Distinctively Different

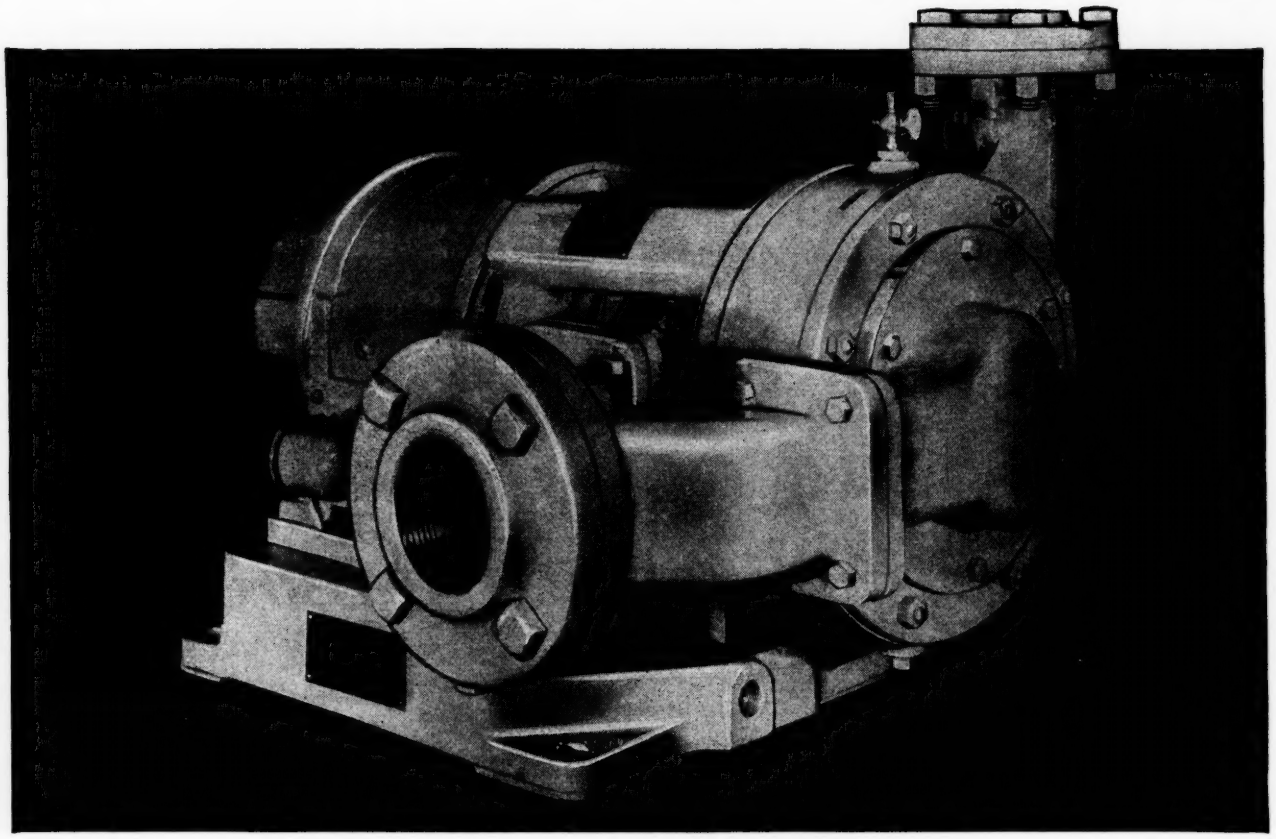


AMES
Vacuum Heating Pumps are Characterized by Excellence of Materials and Design, Simplicity, Accessibility and Efficiency.

THEIR PERFORMANCE IS BUILT IN.



AMES PUMP COMPANY, *Inc.*
30 Church Street -:- New York City
AFFILIATED WITH
AMERICAN LOCOMOTIVE COMPANY



Jennings Double Suction Centrifugal Pumps are furnished in standard sizes with capacities up to 500 g.p.m. Heads up to 320 feet.

Five outstanding features distinguish this house service pump

1. Only one stuffing box
2. No bearings in pump casing
3. Motor and pump are on the same shaft
4. Impeller removable without disturbing packing or piping
5. Inlets and outlets assembled in almost any desired position

These features are real advantages. They result in ease of installation and make this new Jennings Pump easy to take care of.

Piping is facilitated by a unique design which affords a choice of four different positions for the inlet connection and eight for the discharge connection. Merely unbolting the pump head gives ready access to the interior for inspection or cleaning. The impeller, mounted on a short extension of the motor shaft, is removable without disturbing packing, piping or shaft alignment.

Wherever pumps are required for such work as circulating hot or cold water in buildings or boosting city water pressure to supply top stories, reliable, trouble-free service can be assured by installing Jennings Double Suction Centrifugals.

If you are not familiar with Jennings Pumping equipment for house service, complete information will be sent on request.

Jennings Pumps

THE NASH ENGINEERING CO 81 WILSON ROAD, SOUTH NORWALK CONN.

Trade and Miscellaneous Notes

Coming Events

March 31-April 5, 1930. New York's twelfth annual Home Show at the Grand Central Palace, New York.

April 7-12, 1930. Seventh annual convention of the American Oil Burner Association in Chicago, Ill. Headquarters at the Hotel Stevens.

May 5-7, 1930. Convention of the National Pipe and Supplies Association, at Pinehurst, N. C. Headquarters at the Carolina Hotel.

June 3-5, 1930. Twenty-first annual convention of the National District Heating Association in St. Louis, Mo. Headquarters at Coronada Hotel.

June 24-27, 1930. Summer meeting of American Society of Heating and Ventilating Engineers, Minneapolis, Minn. Headquarters at Curtis Hotel.

Additions to Committee on Trade Survey

With the announcement of 17 additional members of the National Survey Conference Committee, the civilian organization charged with carrying forward President Hoover's ideas for preventing a psychological depression in the wake of the recent stock market collapse, the work of the conference was virtually completed. Among the 17 appointed were: Harry M. Hart, Chicago, Ill., Heating and Piping Contractors National Association, and Max Baumann, New York, National Association of Builders' Exchanges.

New Vice-President for Pierce, Butler & Pierce

Martin A. Rooney, for many years connected with the American Radiator Company, has been appointed vice-president and general manager of sales of the Pierce, Butler & Pierce Mfg. Corp., 41 East 42nd St., New York. E. T. McCormack, formerly eastern district manager of the Pierce corporation, has been appointed assistant general manager of sales.

Colonel Archer Leaves Bureau

Col. W. G. Archer will discontinue his work with the Plumbing and Heating Industries Bureau, as announced recently by the board of directors, due to lack of funds for carrying on this work. During the eight years he was connected with the bureau, Colonel Archer has delivered almost 1900 lectures on various phases of heating and plumbing as it affects public welfare.

New Westinghouse Laboratory Will Reproduce Weather Conditions

An expenditure of $1,500,000 will be made by the Westinghouse Electric and Manufacturing Company in the construction of a central engineering laboratory and an addition to the present direct current power laboratory, both in East Pittsburgh. This was announced last month.

"The buildings will house one of the world's best equipped electrical laboratories," it was stated. "Generators big enough to supply electricity to a town of 10,000 people will be used merely for experiments. Artificial lightning for testing insulating materials will be produced by a high-voltage surge generator. Test circuits of almost any voltage and frequency will be provided for.

"Making artificial weather — hot or cold—will be every-day routine in the weathering rooms where sunshine or rain, winter cold or summer heat, will be produced for testing apparatus built for outdoor service. In another room any given set of atmospheric conditions of temperature, pressure, and humidity may be accurately reproduced.

"Six upper floors of the new building will be used for engineering offices and the remaining floors will house miscellaneous experimental work. The active floor space will be about equally divided between engineering laboratory and office accommodation."

Work has already started on the laboratory, an eleven-story structure 80 ft. wide and 225 ft. long. Adjacent to this building will be the 125-ft. extension to the direct current laboratory.

W. S. Rugg, Vice-President, Westinghouse Electric & Mfg. Company, Breaking Ground for New Engineering Laboratory in East Pittsburgh

New Empire State Building to Use District Heating

The Empire State Building, owned by a company of which former Governor Alfred E. Smith is president, to be located on the site of the old Waldorf-Astoria Hotel, Fifth Avenue and 33rd-34th Sts., has contracted with the New York Steam Corporation for its entire steam requirements.

This new skyscraper, rising to a height of approximately 1300 ft., is claimed to be the tallest structure in the world, also being the first building to be surmounted with a mooring mast and proposed landing station for dirigibles.

Miscellaneous Notes

December building operations, as reported by the F. W. Dodge Corporation, showed a decrease of 19% below the total for November, 1929, and 27% below the total for December, 1928. The total figures for the 37 states east of the Rocky Mountains were $316,368,100. Analysis of this record shows that 36% of all construction was for residential buildings, 21% for industrial projects, 16% for public works and utilities, 11% for commercial buildings, and 6% for educational buildings.

Construction contracts recorded during the year 1929 in the 37 eastern states reached a total of $5,754,290,500. Compared with the total for 1928, this was a decrease of 13%. The decline was most severe in residential buildings, the total of which was 31% below the total for 1928.

Contracts in New York State and Northern New Jersey amounted to $115,187,900, representing a decrease of 31% from the preceding month, and 17% from the total for December, 1928. In the New England States the figures amounted to $15,946,000, a decrease of 34% from the total for November, and 43% from the total for December, 1928.

In the Middle Atlantic States contracts amounted to $21,389,900, almost

a 50% decrease from November, 1929, and about 60% below the total for December, 1928. Contracts in the Pittsburgh District amounted to $27,332,000, representing an increase of 2% over November, 1929, but a decrease of 30% from December, 1928.

Figures in the Central West amounted to $97,352,700, showing an increase of 13% over the total for November, 1929, and 19% under the total for December, 1928. In the Northwest contracts amounted to $6,866,900, a decrease of 31% from the total for November, 1929, but a decided increase of 79% over December, 1928. Contracts in the Southeastern States amounted to $20,221,600, a decrease of 9% from the November, 1929, total and 40% below the total for December, 1928. Texas reports contracts amounting to $12,071,100, a slight decrease from November, 1929, and a decrease of about 30% from the total for December, 1928.

The Anthracite Club, of New York, has taken permanent headquarters at the McAlpin Hotel, 34th Street and Broadway, and will hold its meetings in the future at that hotel.

Manufacturers' Notes

Freeman Mfg. Co., Racine, Wis., announces the following new officers: President and treasurer, L. A. McDowell, formerly in charge of manufacturing and engineering of the Murray Corporation of America; vice-president, Arthur Janes, who is president of the Standard Foundry of Racine; secretary, Victor D. Werner. In addition to these executives, the following also are on the board of directors: W. Harold Pugh and Thomas B. Myers. This company was established by Stephen Freeman in 1868, and manufactures a general line of steam boilers for power and heating. Branch offices for the boiler division of the company are located in the leading industrial cities.

The Ric-wiL Co., Cleveland, O., held its annual sales meeting at the home office during the week of January 6. Plans to take care of the rapidly expanding organization were discussed, and it was decided to establish branch offices at New York, Chicago, Boston, St. Louis, Baltimore and Atlanta with J. A. Dougherty, vice-president and sales manager, C. Harrington, eastern division manager, F. Belser, central division manager, F. Austin, western, and R. V. Klein, southern division manager.

The Eastern Heating Division of the Modine Mfg. Co., of Racine, Wis., manufacturers of unit heaters and domestic copper radiation, held its 1930 sales convention at the Hotel Commodore, New York, January 24-25. Sales and advertising plans for 1930 were discussed at the meeting. The home office was represented by M. S. Potter, general manager, A. G. Dixon, western sales manager, W. J. Burke, eastern sales manager, and O. E. Desmond, advertising manager.

National Radiator Corp., Johnstown, Pa., announces that John H. Waters, chairman of the board of directors, has been elected president, succeeding Grant Pierce, who has retired, after holding office for the past year and a half. Charles L. Crouse, vice-president, will now have charge of all merchandising activities for the company. The board of directors decided that the executive offices would be moved from New York City to Johnstown. This removal will take place immediately, and it is hoped will lead to substantial economy, inasmuch as the executive offices will be consolidated with the general offices.

C. A. Dunham Co., Chicago, Ill., has purchased the business of the Dwyer Equipment Co., Chicago, makers of unit heaters, and has acquired all of the outstanding capital stock of the Dwyer Company. Lawrence P. Dwyer, president of the Dwyer Company, will become general manager of the unit heater division of the Dunham Corporation, and William J. Mauer, vice-president of the Dwyer Company, will become sales manager of the same division. Mr. Dwyer and Mr. Mauer will be located at the general offices of the Dunham Company, 450 East Ohio Street.

Worthington Pump and Machinery Corp., 2 Park Ave., New York, announces that the interests of the corporation in the California territory will be served through a local company, the Worthington Machinery Corporation of California, Ltd., with headquarters at Los Angeles and San Francisco. H. D. Cornell, who has been president of the Worthington Machinery Corporation of Oklahoma, will be president of and direct the new corporation, moving to California for that purpose. George W. Hawkins, who has been director of sales, has been appointed vice-president, and will also have his headquarters in California. The new organization in California will take over the sales and engineering staff and the warehouse facilities of the Worthington Co., Inc., in California, and will handle all of that territory.

Simplex Oil Heating Corp., 30 Church St., New York, has become the national sales headquarters for Simplex oil-burning equipment. Up to this time the company has been eastern sales representative, whi'e the Bunting Iron Works, Berkeley, Calif., in addition to manufacturing the Simplex oil burner, was western sales representative. The Bunting Iron Works will now devote its entire organization and resources to the continued manufacture of the equipment, whereby the New York company will devote its entire endeavors to sales and installations. H. L. Delaney, formerly sales manager of the Bunting Iron Works, has become manager for the Pacific division of the Simplex Oil Heating Corp., with offices at 820 Parker St., Berkeley, Calif. With few exceptions, the same dealers will still represent Simplex. Other dealers interested in unsigned territory for the sale of this burner are invited to write to the New York or California headquarters.

Bryan Steam Corp., Peru, Ind., held its annual salesmen's meeting and convention in Peru during the week of January 7. Plans were made on the basis of doubling the sales for 1929.

The Silent Automatic Corp., Detroit, Mich., has moved to its new plant on East Jefferson Avenue. An announcement recently made is that the corporation has acquired the patents, processes and methods of the Uni-Lec-Tric Burner Corp., of Paterson, N. J. This new acquisition will enable the company to manufacture three oil burner models. Sales of burners, it was announced by the company, have increased nearly 100%. As stated in one of the trade journals, this company attained top position in the industry during 1929 in point of sales and production.

John J. Nesbitt, Inc., Philadelphia, Pa., reports that Thomas M. Reed, Jr., for several years with the home office and also at Cleveland, O., will be associated with the New York office organization at 11 Park Place, New York, and will devote his activities to New York City, Long Is'and and Westchester County.

Buffalo Forge Co., Buffalo, N. Y., recently held its annual meeting and the following officers were elected: H. W. Wendt, Jr., chairman of the board; Edgar F. Wendt, president and treasurer; Charles A. Booth, vice-president, and Herbert S. Whiting, secretary.

Buffalo Steam Pump Co., Buffalo, N. Y., at its annual meeting elected the following new officers: Edgar F. Wendt, president and treasurer; Henry W. Wendt, Jr., vice-president; Amos G. Peterson, secretary, and Robert G. Nye, factory manager. These officers also are directors of the company.

Young Radiator Co., Racine, Wis., announces the appointment of George H. Palm, as engineer in charge of radiator construction and equipment. Mr. Palm, for the past six years, has been engineer with the new development division of the Yellow Coach and Mfg. Co., Pontiac, Mich.

NATIONAL COPPER-STEEL PIPE... *in the beautiful Lexington*

HOTEL LEXINGTON
New York City

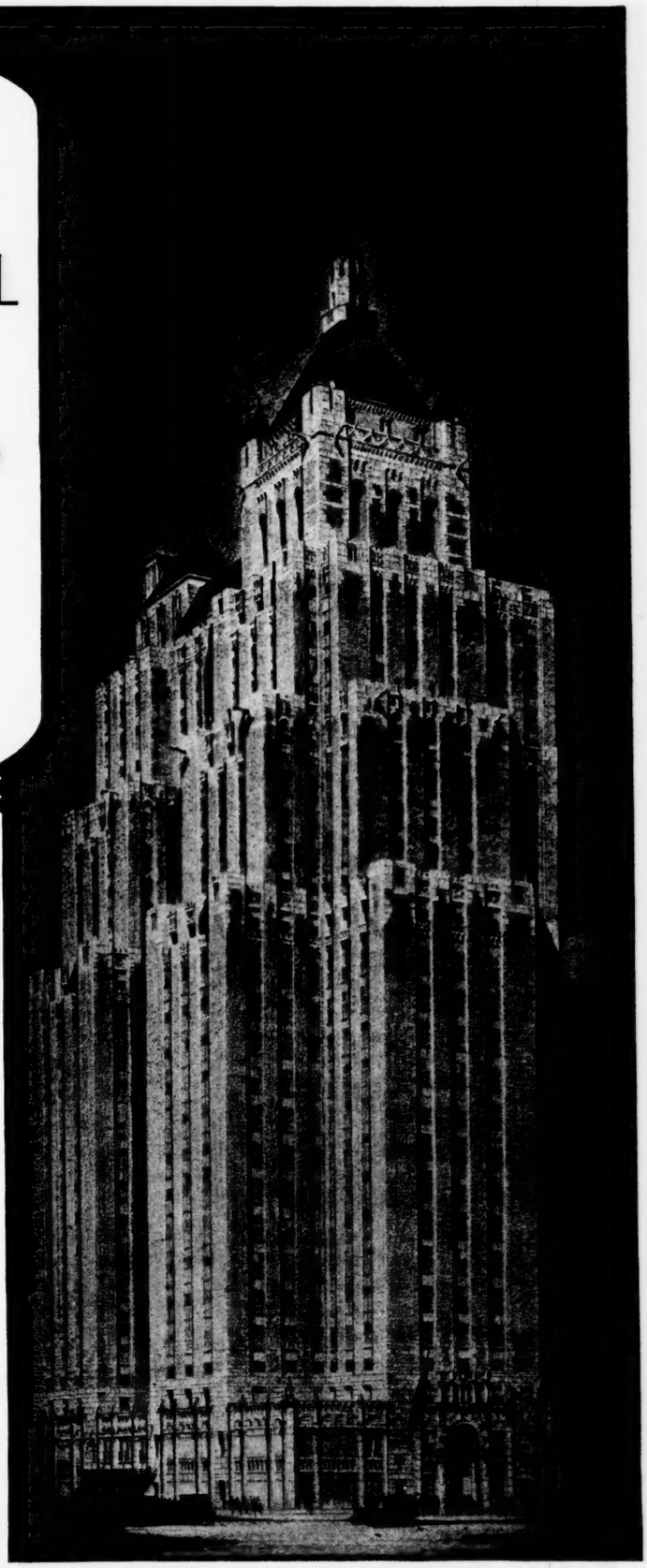
Architect: Schultze & Weaver, New York City
Consulting Engineer: Clyde R. Place, New York City
General Contractor: Turner Construction Company, New York City
Heating Contractor: Baker, Smith & Co., New York City
Plumbing Contractor: Geo. E. Gibson, Co., New York City

NEW York's newest hotel . . . an exemplification of modern hotel creation . . . beautiful without . . . beautiful within. Situated in the Grand Central Zone of America's greatest city, the Lexington boasts of impressive companionship . . . many of New York's finest buildings are its neighbors. In this zone are the Chrysler Building, Chanin Building, Graybar Building, Postum Building, New York Central Building, Park Lane Hotel, Roosevelt Hotel, The Barclay, and the Ambassador . . . all mighty in their fame . . . all contain National Pipe.

Thus, the architects, contractors and engineers, valuing highly the responsibility of planning such a structure, specified and used tried and proven equipment . . . equipment that befitted the building . . . its neighbors. National was used for the major pipe tonnage, including National Copper-Steel Pipe (especially resistant to atmospheric corrosion) in the soil, waste, vent lines and rain leaders. National Copper-Steel Pipe was also used in part of the drainage lines of the Chrysler Building, mentioned above.

Send for Bulletin No. 11, describing

NATIONAL COPPER-STEEL PIPE
The Original Copper-Steel Pipe



NATIONAL TUBE COMPANY
Frick Building, Pittsburgh, Pa.
SUBSIDIARY OF UNITED STATES STEEL CORPORATION

PRINCIPAL SUBSIDIARY MANUFACTURING COMPANIES:

AMERICAN BRIDGE COMPANY
AMERICAN SHEET AND TIN PLATE COMPANY
AMERICAN STEEL AND WIRE COMPANY
CARNEGIE STEEL COMPANY
CYCLONE FENCE COMPANY
FEDERAL SHIPBUILDING AND DRY DOCK COMPANY
ILLINOIS STEEL COMPANY
MINNESOTA STEEL COMPANY
NATIONAL TUBE COMPANY
THE LORAIN STEEL COMPANY
TENNESSEE COAL, IRON & R. R. COMPANY
UNIVERSAL PORTLAND CEMENT COMPANY

Pacific Coast Distributors—United States Steel Products Company, San Francisco, Los Angeles, Portland, Seattle, Honolulu. *Export Distributors*—United States Steel Products Company, New York City

Williams Oil-O-Matic Corp., Bloomington, Ill., held its annual sales conference at its factory from January 6-11. More than 100 salesmen and divisional managers were present. Markets, financing methods, sales, service and advertising were discussed in detail in all-day sessions. The conference also included schools of instruction in the latest features of the Williams Oil-O-Matic Model J and Junior oil burners, the Ice-O-Matic refrigerating machines, and Dist-O-Stove.

Richardson & Boynton Co., 260 Fifth Ave., New York, has appointed Walter L. Fleisher as technical advisor for the further development of domestic heating and air conditioning. In 1925, Mr. Fleisher sponsored and was vice-president and chief engineer of the Cooling and Air Conditioning Corporation. He also has been chairman of the standardization committee of the H. & P. C. N. A., and for several years served as president of the New York Chapter of the A. S. H. V. E. Another appointment is that of William A. Shay, manager of the New England Branch of the company. Mr. Shay was connected with the company for 20 years, first in the engineering department of the New England branch and later in the sales department. Mr. Shay, who succeeds Harry Anness, will retain the offices and showrooms at 80 Federal St., Boston.

Wilfred R. Wood and the Irving Trust Company, receivers of Combustion Engineering Corp., New York, announce the appointment of Joseph V. Santry as head of the organization, succeeding Col. H. D. Savage, who is assisting the receivers. Mr. Santry was associated with the company as director and vice-president in charge of sales for five years and as president for four years. He resigned about two years ago.

Time-O-Stat Controls Co., Elkhart, Ind., held its first annual convention at Hotel Elkhart, January 15-18, which was attended by distributors of the company from all points of the United States and Canada. An address of welcome was delivered by Julius K. Luthe, and a complete tour of inspection of the modern daylight plant of the company was made by the 100 men attending the convention. Several sessions were held during the four days and the company's policies and program for 1930 also were discussed.

Hart Oil Burner Corp., the new corporate name of Preferred Oil Burners, Inc., Peoria, Ill., at a recent stockholders' meeting elected the following officers: L. A. Welch, president and general manager; George L. Luthy, vice-president; R. S. Bohn, vice-president; L. V. Tefft, vice-president. These officers and J. Paul Schnellbacher are also directors of the company. F. G. Cowan was elected secretary and treasurer.

Niagara Blower Co., Buffalo, N. Y., reports that W. G. R. Braemer, will direct the Philadelphia office of the company in the La Fayette Bldg., Philadelphia, Pa. Mr. Braemer has been specializing in air conditioning for many years.

The Sundstrand Engineering Co., Rockford, Ill., has appointed H. W. Bensen, St. Cloud, Minn., and Hamilton Bros., Gulfport, Miss., as dealers for Sundstrand oil burners in their respective cities.

Crystal Oil Burner Corp., 1440 Broadway, New York, announces the appointment of Ben W. Mathes as sales manager. Mr. Mathes formerly was connected with the S. T. Johnson Company as a distributor and in the sales department.

Even-Heat Oil Burner Corp., 500 Fifth Ave., New York, announces that W. F. Gilinsky, chief engineer for the Liberty Oil Burner Co., Lincoln, Nebr., is in New York for the purpose of a conference with all the Liberty dealers. It also is announced that an extensive advertising campaign will be released for dealers and distributors throughout New England, Pennsylvania and Ohio.

Abram Cox Co., Lansdale, Pa., announces that it will concentrate all of the manufacturing and shipping of Novelty boilers and furnaces at its Lansdale plant. Also that a new Philadelphia office and showroom will be established.

Evins F. Glore & Son, Inc., 5037 Grand Central Terminal Bldg., New York, was appointed distributor for the products of Kainer & Co., Chicago, Ill., in the metropolitan district of New York.

The Wickes Boiler Co., Saginaw, Mich., announces the appointment of the Coon-DeVisser Co., 2051 West Lafayette Blvd., Detroit, Mich., as its representative for that district.

Fluid Heat Corp., Baltimore, Md., announces the appointment of T. H. Smoot, formerly of the engineering department of the Petroleum Heat and Power Co., Stamford, Conn., as chief engineer of the company.

H. A. Thrush Co., Peru, Ind., reports that one story has been added to the plant, and the new floor will house the general offices, including the accounting, general sales and engineering departments. Louis Dietz, formerly with the Walworth Mfg. Co., has been appointed as New York representative of the Thrush Company.

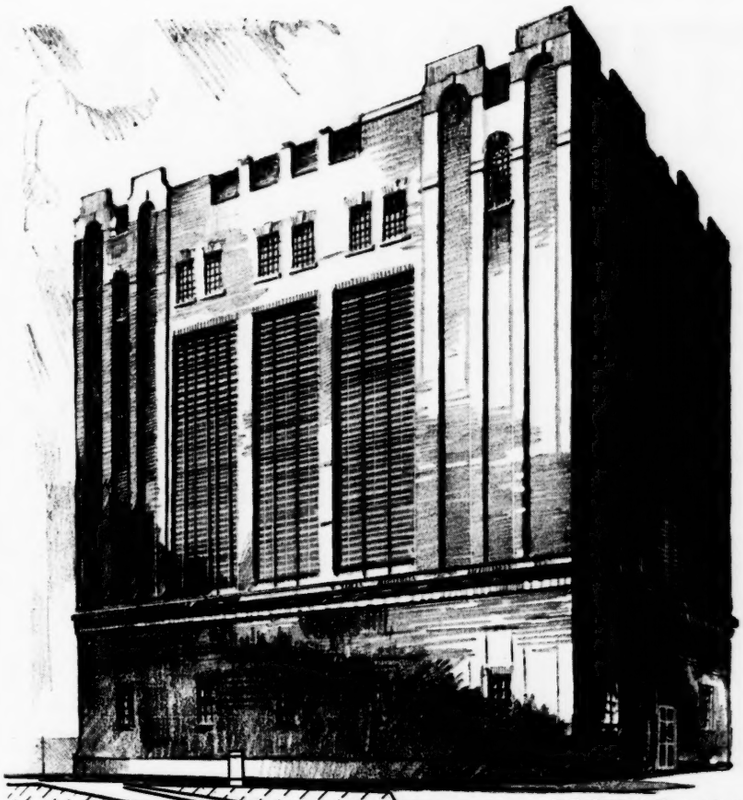
Electrol, Inc., New York, states that I. M. Nelson has joined the organization as general manager of the company's branch office at Chicago, Ill. Mr. Nelson formerly was vice-president and general manager of the Sword and Kimber Co., Philadelphia, Pa. Robert O'Brien has been appointed district manager in charge of Missouri and Kansas.

Brown Instrument Co., Philadelphia, Pa., announces the appointment of E. B. Nichols as its chief engineer. Mr. Nichols is well known for his activities in the A.S.M.E. He will act in an administrative capacity, supervising the work of the engineering staff.

Change of Address

Newport Boiler Co., Chicago, Ill., announces that new headquarters for its general offices will be located in the Chicago Daily News Bldg., 400 West Madison Street.

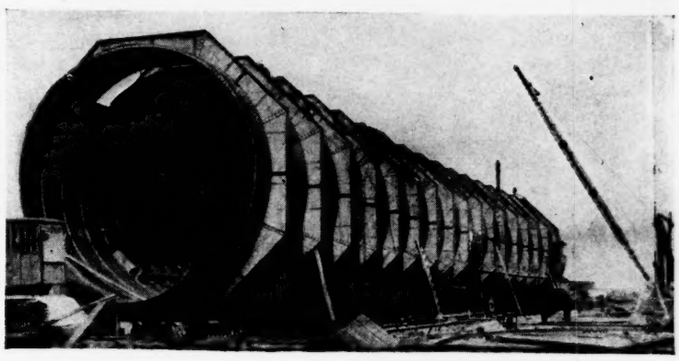
Convention of Time-O-Stat Controls Company



One of the Ventilation Buildings. Construction by Parklap Construction Corp. for the Detroit-Canada Tunnel Co.

The International Air *will always be good in the* DETROIT-CANADA TUNNEL

SILENTVANES *were chosen!*



—It was because of a reputation for low operating cost that Silentvanes have built up for themselves in the Holland Tunnels and the George A. Posey Tube in California . . .

—and because of Sturtevant's special experience in building fans for this kind of work . .

. . . Silentvanes were chosen!

The new tunnel connects Detroit, Michigan and Windsor, Ontario. It consists of a single tube 5100 feet long with a roadway 22 feet wide. There are two ventilating buildings—one in Canada and the other in the United States.

To keep the air pure at all times—even in emergencies—twenty-four Sturtevant Silentvane Fans were chosen—twelve Blowers and twelve Exhausters. Capacities range from 61,500 to 195,000 C.F.M. Under maximum operating requirements, the load will be about 900 H.P.

Architects and Engineers are invited to make use of the Sturtevant Research Laboratories where valuable cooperating facilities are available in the development of special ventilating apparatus.

River Tube construction by Porter Bros. & Robt. Porter for the Detroit-Canada Tunnel Co.,

Plans and specifications by Parsons, Klapp, Brinckerhoff and Douglas, New York City.

Ole Singstad, Consulting Engineer on Ventilation.

Sturtevant

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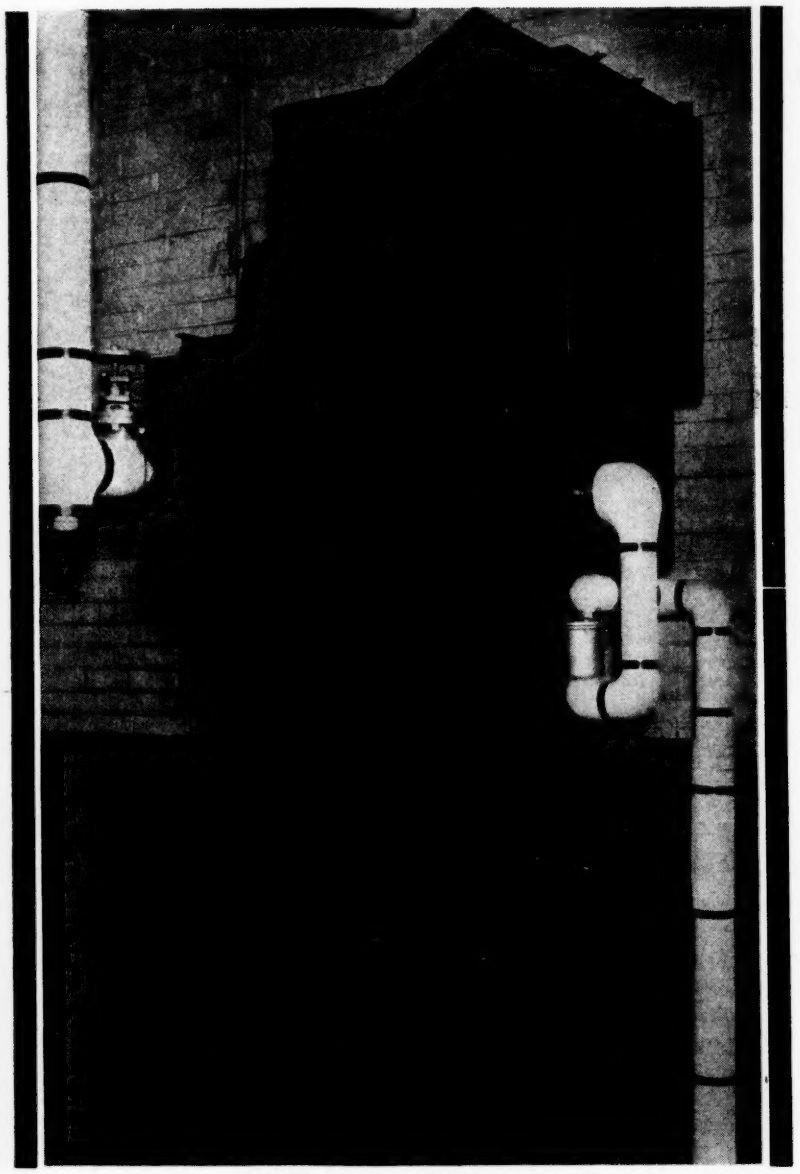
"TIE A CAN" *to trap troubles*

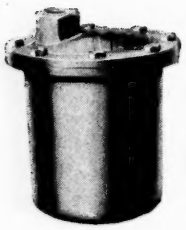


Armstrong inverted bucket steam traps give practically attentionless service on unit heaters.

MR. HOLLIS M. JOHNSON of the American Appliance Co., writes: "We have now sold a lot of Unit Heaters and they have been equipped with all kinds of traps, and we have found that almost invariably the Armstrong Traps have given perfect service. We have had quite a number of jobs where they have had to take other traps off and put on Armstrong traps."

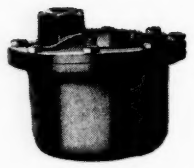
Features of Armstrong traps that contribute to their outstanding performance are: small size with large capacity; no air-binding; self-scrubbing; low radiation loss; no steam leakage or wire drawing in valves. All working parts are inside; the trap can be supported by the connecting pipes.

We are glad to give you additional data and cooperate with your engineers in determining trap sizes and efficient layouts.



No. 31

The Nos. 30 and 31 Armstrong Steam Traps commonly used for individual draining of unit heaters.



No. 30

ARMSTRONG MACHINE WORKS

346 Maple Street,

THREE RIVERS, MICHIGAN

District Representatives in 42 Cities

ARMSTRONG "INVERTED BUCKET" STEAM TRAP

H & V 2-Gray

Tests by The U. S. Bureau of Standards and Scientific Fact

Prove the Greater Insulating Value of Flax-li-num

A 50% Increase in Efficiency is Made Possible by the FLAX-LI-NUM "Two-Air-Space" Method of Application

FEW statements sum up the FLAX-LI-NUM "two-air-space" method of insulation as clearly and as completely as the following quotation from the U. S. Bureau of Standards Letter Circular No. 227: "If a layer of material is placed in the middle of a wide air space, such as that between the studs in a frame wall, greater additional insulating value is obtained than if the material is placed in contact with the sheathing, or as a plaster base, as has been assumed in the calculation for table (3). In the former case, the insulating layer not only furnishes its own insulating value, but in addition, divides the air space into two parts, each of which has about the same insulating value as the original air space. The insulating value of an ordinary air space more than about one inch in width is equivalent to about ¼ inch of insulating material. The addition of a half inch layer of insulation in the middle of the air space in a frame wall is, therefore, the equivalent of adding about a ¾ inch layer at some other place in the wall."

There is little more to be said. The U. S. Bureau of Standards judges only upon scientific fact. FLAX-LI-NUM was developed and perfected upon scientific fact. It is a semi-rigid insulating material, designed to be applied by the "two-air-space" method to walls and ceilings or roof of homes. It is made in full one inch and ½ inch thickness. When in place in the walls and ceilings or roof FLAX-LI-NUM is permanent. It will not rot, crack, break, tear or otherwise lose its insulating value.

If you are interested in the FLAX-LI-NUM "two-air-space" method of application, we will gladly send you a copy of the FLAX-LI-NUM Manual for your files. When pure insulation . . efficient and permanent . . is desired, FLAX-LI-NUM stands alone in its heat-stopping value.

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ST. PAUL, MINN.

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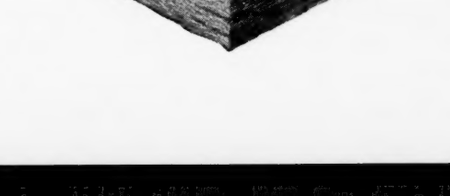

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St. Paul, Minnesota

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Also facts about the "two-air-space" method.

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A leading Company in its field seeks a Sales Engineer for its Eastern Pennsylvania territory. Must have a demonstrably successful record of several years' selling of heating or allied specialties to Engineers, Architects and Contractors in this section. A following and a proven earning capacity in this field of over $5000 absolutely essential. Compensation in liberal proportion to results. Give complete details of record and when available, in first letter, in strict confidence to "President," Box 89, care of Heating and Ventilating.

The New York Blower Company requires successful and experienced fan and unit heater salesmen. For further information address The Sales Manager, 3155 Shields Avenue, Chicago, Ill.

Young man, 24, college education, 2 years' experience as draftsman for large manufacturer desires change. Will locate anywhere. Good references. Address Box 90, care of Heating and Ventilating.

SALESMAN to sell a non-conflicting high grade specialty direct to the Plumbing and Heating trade. Liberal commission and repeats. Some Territory open. Address Box 91, care of Heating and Ventilating.

Heating and Ventilating Sales Engineers with successful sales experience in fan industry wanted. Address application to Box 92, care of Heating and Ventilating.

ENGINEERING SALES REPRESENTATIVE for Central and Western Pennsylvania wanted. Wide acquaintance among Engineers and Architects of school buildings, and experience in heating and ventilating equipment, necessary. Generous remuneration and co-operation to right man. State fully all qualifications to "Treasurer," Box 93, care of Heating and Ventilating.

A Manufacturer of Steel Heating Boilers desires to make connections with salesmen or sales organizations who at present are engaged in selling equipment to heating contractors. Exclusive territory to reliable parties. Address Box 94, care of Heating and Ventilating.

STEAM HEATING ENGINEER — Eastern Utility, expanding District Steam Heating business, has vacancy for Sales Engineer between 25 and 35 years of age. Should be a technical graduate and have knowledge of steam metering, rates, contracts and service conditions in supplying steam to customers. An excellent opportunity. Please state age, experience and salary desired. Replies will be treated confidentially. Address Box 95, care of Heating and Ventilating.

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Only those with technical education and thoroughly experienced in one or more of the lines will be considered. Give complete history of selling experience with reference to territory covered, name of company now associated with, etc. Applications confidential.

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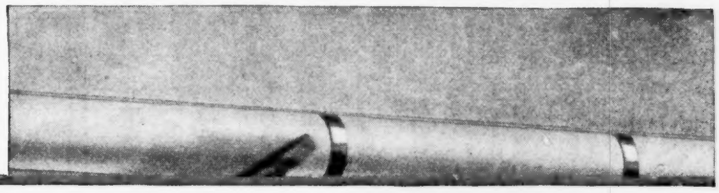

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It is Made to Stand Up Under Rapid Handling

ONE look at an actual piece of Asbestocel would convince any plumber that this improved pipe covering can be counted upon to make a neat job without having to handle it with kid gloves. Even an accidental bang from a stepladder, or a ten foot drop to the floor will not damage Asbestocel because it is made more than strong enough to give a lasting, first class job.

Remember every section of Asbestocel is perfectly designed to save money for you and your customers. Every piece of Asbestocel is of uniform length, roundness and thickness. It is straight-lined and clean-cut. It snaps shut like a book over the pipe and fits firm and smooth for all time. Asbestocel makes a job of which you can be proud.

Improved Asbestocel is a precision product, scientifically made for its work. The cross corrugations may seem a small matter. Yet they gain for Asbestocel two advantages which ordinary air cells lack. There are 8 to every 36 inch length. Thus there are 8 hips, or ridges, which add greater strength to the covering. In addition, by cutting the longitudinal air chambers into small cells the cross corrugations stop circulation of air within the insulation and greatly increase its effectiveness.

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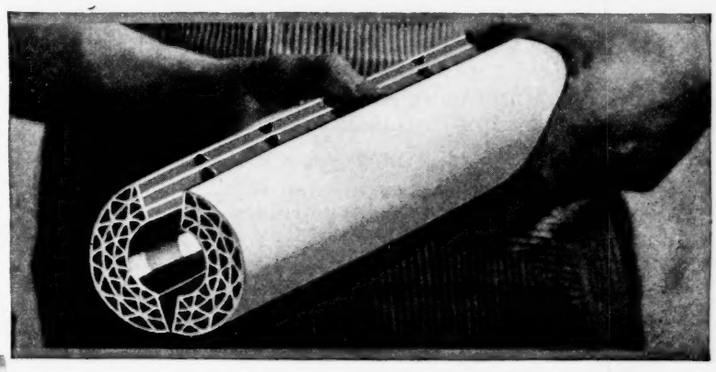
Note the cross corrugations shown in this close-up photograph. This construction is only found in "Improved Asbestocel."



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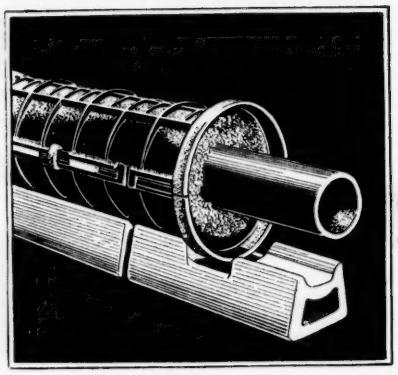

Ric-wiL Cast Iron Conduit Type F with Dry-paC. Cast iron base drain furnished if desired.

SPECIAL field construction, with its engineering, laying-out, getting together a variety of materials, delays, and greater expense, is eliminated with Ric-wiL Conduit. No matter what the conditions, Ric-wiL Conduit is completely ready for them—the work goes ahead with machine-like speed and efficiency.

Where the steam lines run under railroads or heavy traffic, there is Ric-wiL Cast Iron Conduit to insulate and protect them. It is far stronger than the load actually demands. And it has all the Ric-wiL features that give speedy economical installation: Base drain foundation, Loc-liP side joint, independent pipe supports and Dry-paC waterproof insulation. These in Ric-wiL closed construction account for moderate costs and for efficiency test results averaging well over 90%.

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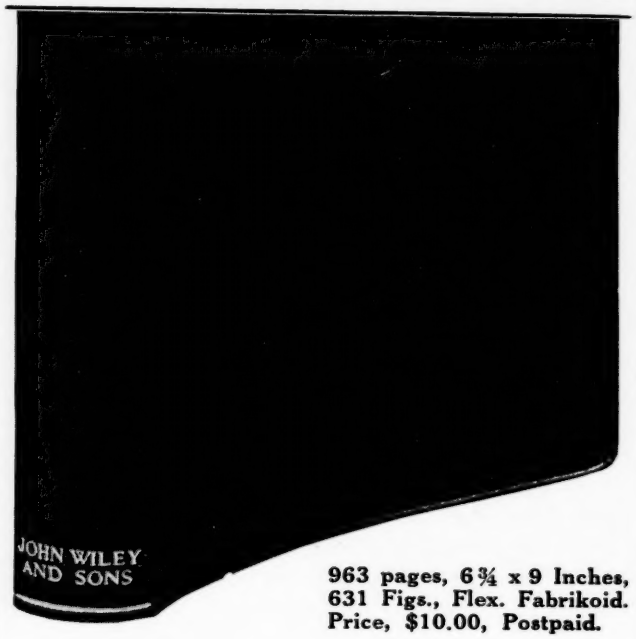

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INSULITE
the Wood-Fiber Insulating Board

has this Important Feature

ROOF INSULATION with a shiplap edge is an improved and important feature found only in Insulite. When laying Insulite Roof Insulation, the shiplap edges overlap one inch on all four edges—they do not butt together like ordinary insulation boards. These lapped edges are laid in a bond of pitch or asphalt—there are no uninsulated spaces, but a full 1 inch of insulation over the entire roof.

And here's another good reason for the shiplap edge—should one of the units become damaged through an accident, moisture cannot seep from that unit into adjoining ones, thus impairing the insulating efficiency of a large area and making extensive repairs necessary. To repair Insulite Roof Insulation, simply remove the single damaged unit and replace with a new one—the job can be done easily, quickly, and economically.

Insulite is an all wood-fiber product, chemically treated to resist moisture and is not subject to deterioration. Ice formation does not injure Insulite or cause it to disintegrate. Its great tensile strength makes Insulite easy to work with and eliminates loss from breakage.

In addition to the shiplap edge, Insulite has many other features and advantages well worth inquiring about. Let us send you samples and complete information.

THE INSULITE COMPANY
(A Backus-Brooks Industry)
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INSULITE
the Wood-Fiber Insulating Board

INSULITE Roof Insulation is built with two layers of standard ½ inch Insulite offset a full 1 inch to make the shiplap, and firmly stapled together with non-corroding steel wire. The completed panel is 17"x34" and a full 1 inch thick—which means 12½% more efficient insulation than ordinary ⅞ inch insulating boards.

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The Engineering Department of The Insulite Company has prepared a booklet, "Roof Insulation and the Prevention of Condensation." It contains much valuable data. We will gladly send you a copy free—and remember, our Engineering Department is at your disposal at any time. You are obligated in no way.

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Gentlemen: Please send me your free Booklet described above. Also a sample of Insulite.

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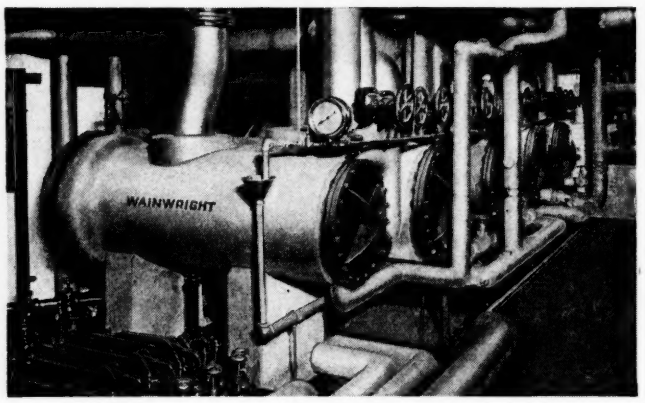
A Dependable Hot Water Supply



Wainwright heaters that supply hot water in one of the leading New York hotels. Wainwright heaters are available in both vertical or horizontal types.

Wainwright heaters are built for any size project, hotels, apartments and hospitals.

Wainwright hot water heaters are built to meet any capacity requirements or temperature range. Either exhaust or live steam may be used for heating the water.

The Wainwright hot water heaters installed in one of the largest and most modern of New York hotels are shown in the accompanying illustration. Besides supplying guests, kitchens, etc., the complete hotel laundry is furnished with hot water from these heaters.

The piping and valves are so arranged that the high, intermediate and low pressure heaters are interchangeable. This permits one heater to handle the hot water supply for all floors in cases of emergency.

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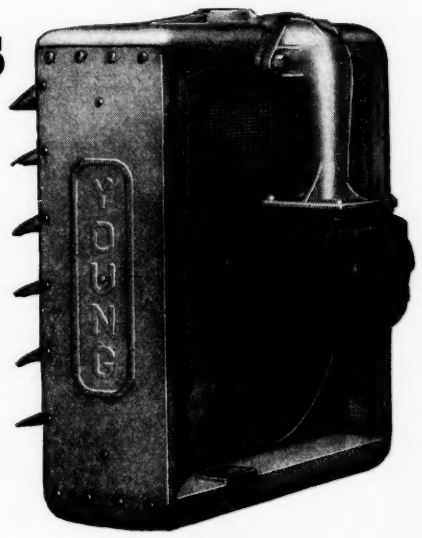
FOSTER WHEELER

Exclusive Features

Unit heaters had to come, of course—they are in line with progress. Unit heaters in general are superior in performance to the old methods of heating. But from that point on there is a difference. Young Unit Heaters embody many features which contribute an extra measure to the efficiency of this unit. Less weight, greater volume of heated air, lower power cost, longer life, are direct and actual results. There are other points in which you may be equally interested. Full details in our current bulletin—write for it.



YOUNG RADIATOR COMPANY
Heating Division
RACINE WISCONSIN
Representatives in Principal Cities
Correspondence Invited on Open Territories

Young Unit Heaters

Built for Endurance aud Maximum Performance

Young Quality

Reg. U.S. Pat. Off. © Y. R. Co.

NEW YORK
Herald Tribune

(Copyright, 1929, New York Tribune Inc.) MONDAY, OCTOBER 21, 1929 ****

7 Specialists Named by Wynne On Board to Curb City's Noise

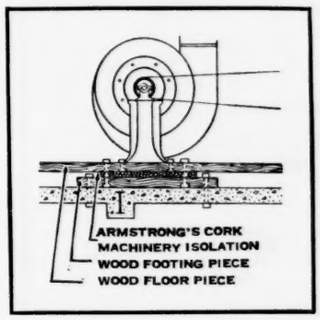
Rioting, Milk Can Rattling, Loudspeakers on Street, Among First Attacked

Dr. Shirley W. Wynne, Health Commissioner of New York, announced yesterday his appointments for the Noise Commission of New York—the first of its kind in the United States—which will have as its duty immediate and progressive action to make this city a healthier and more tranquil place in which to live. The initial meeting of the commission will be held within a fortnight.

The appointments follow:

H. Brown, resident of

New York City has appointed a Noise Commission, the first of its kind in the United States. The purpose of the Commission is the suppression of all unnecessary noises.



Let Cork Isolation be *your* Noise Commission!

"LESS NOISE!" pleads New York City. So seven experts have been appointed to curb unnecessary noise in the great metropolis. It is realized that a quiet city is a more pleasant, more efficient, and a safer place in which to live and work.

Equally desirable is a quiet building. But what about machinery—fans, motors, engines, pumps?

In this case, the noise expert is Armstrong's Cork Machinery Isolation. Wherever machinery is in operation, the resultant vibration and noise can be effectively deadened by cork isolation. On a cork foundation, a machine runs more quietly, smoothly, and efficiently. It is protected against hastened depreciation. So also are nearby machines, gauges, and precision instruments, and the building structure as well. Rooms, apartments, offices, corridors, and workrooms are free from annoying vibration and hum. Armstrong's Cork Machinery Isolation absorbs most of it.

Use Adequate Isolation

Almost any machine can be quieted in this manner. Armstrong's Cork Machinery Isolation is made in three densities and in seven thicknesses, allowing an exact adjustment to almost any operating condition. And the treatment is permanent. Armstrong's Cork Isolation does not harden or "set" under sustained compression and lasts as long as the machine.

Let Us Help You

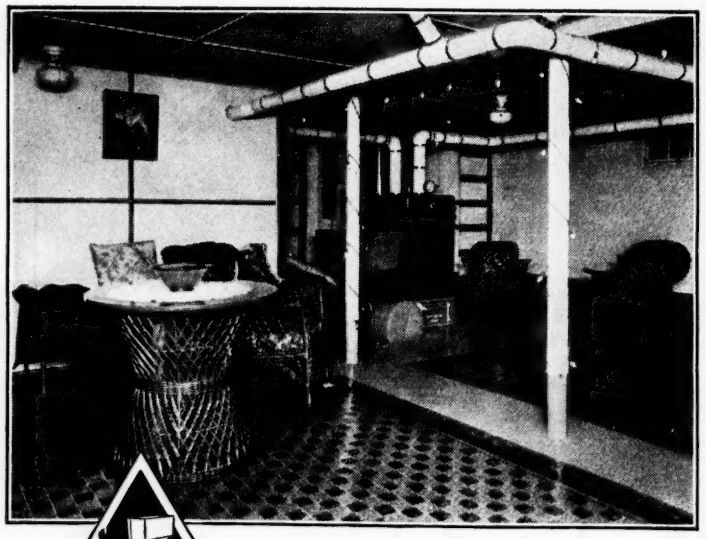
Nor is its use expensive. For just a few dollars, efficient isolation is assured permanently. Armstrong engineers will be pleased to help you, and recommend the proper density and thickness for any moving machinery in apartment house, office building, factory, or any other building. Armstrong Cork & Insulation Company, 925 Concord Street, Lancaster, Pennsylvania.

Protect These Machines

Where can Armstrong's Cork Machinery Isolation be installed? Under practically all moving machinery where noise and vibration are disagreeable, annoying, expensive elements. The list of moving machines that are best benefited by this cork isolation includes: air compressors, blowers, drill presses, drop hammers, elevator hoists, engines, fans, forging machines, machine tools, motors, printing presses, pumps, punching machines, refrigerating machines, vacuum cleaners, and similar apparatus.

Armstrong's Cork Machinery Isolation

Modern Automatic Home Heat



AUTOMATIC ANTHRACITE HEAT

The Modern "Cellar" with the Electric Furnace-Man

Automatic Home Heat is now obtainable without sacrifice of safety, cleanliness or even economy.

Here, at last, is a proven device which may readily be installed in your present heating plant—warm air, steam, hot water or vapor.

Even temperature, no matter how quickly the weather changes. Not on full blast one minute and off the next, but continuous heat in exact proportion to requirements.

Dependable at all times without danger from fire—without smell, smudge or smoke.

Uses the one safe, reliable fuel—Anthracite—now modernized and made automatic.

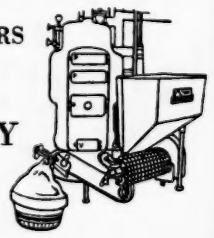
Ideal for hot water supply.

OVER TEN THOUSAND HOMES ATTEST TO THE PERFECTION OF

The Electric Furnace-Man

PATENTED AUTOMATIC COAL BURNER

APPROVED BY ANTHRACITE OPERATORS CONFERENCE—A BILLION DOLLAR INDUSTRY



DOMESTIC STOKER COMPANY
7 DEY STREET, NEW YORK
GILLESPIE BUILDING

HARTMANN
RADIATOR BRACKETS

THREE STYLES
AR NR NV

Write for Descriptive Circular and Price List

CHARLES HARTMANN CO.
975-993 Dean Street BROOKLYN, N. Y.

WE are splendidly equipped to supply all types of finned tubing for copper radiation.

CORRESPONDENCE INVITED

THE G & O MANUFACTURING COMPANY
New Haven, Conn.
Established 1915
Manufacturers of the famous "G & O" Radiators for automotive vehicles

Speaking of Remodeling is This ECONOMY?

Spending $1,528.00
Saving $6,155.38

ILLINOIS HEATING SYSTEMS

THE NIXON BUILDING is one of downtown Chicago's well known office buildings, owned by the Loop Building Corporation.

It was decided to overhaul the existing heating system and change over to an ILLINOIS System. The Illinois Engineering Company made no extravagant selling claims as to what savings could be effected, but knew that the specialties used would produce the maximum saving possible.

The following figures furnished by Mr. E. L. Ladenburger, Superintendent of Building, are accurate, as all steam is supplied by the Illinois Maintenance Co. and is accurately metered. These figures prove conclusively that no owner can afford to overlook the economies and satisfaction obtained with ILLINOIS specialties.

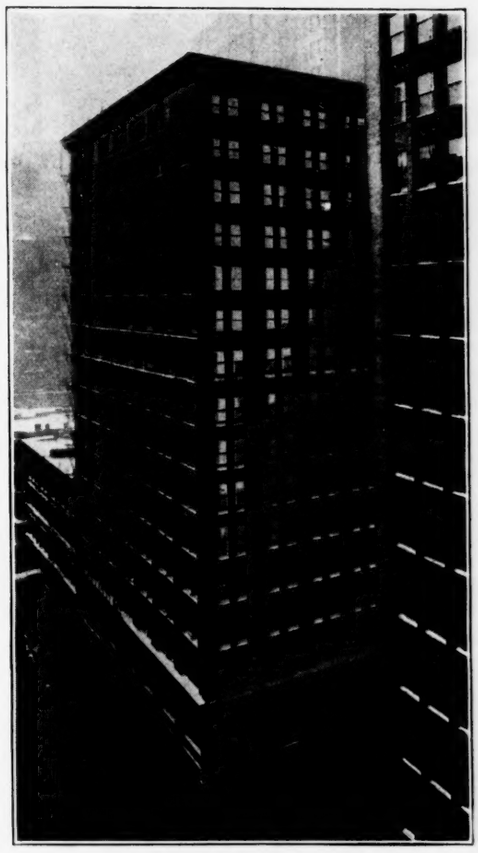
Prior to the installation of our system from October, 1927 to June, 1928
Pounds of Steam used 15,978,000
Cost $15,724.50

New ILLINOIS System from October, 1928 to June, 1929
Pounds of Steam used 10,080,000
Cost $9,569.12

Total Saving—
Steam 5,898,000
Money $6,155.38

The cost of the ILLINOIS Specialties, $1528.00 was saved during the first two months of operation. Installation or change-over was made during spare time without addional expense.

The mean average temperatures for 1927-28 and 1928-29 were practically the same—the difference being 0.3°



Nixon Building, Chicago

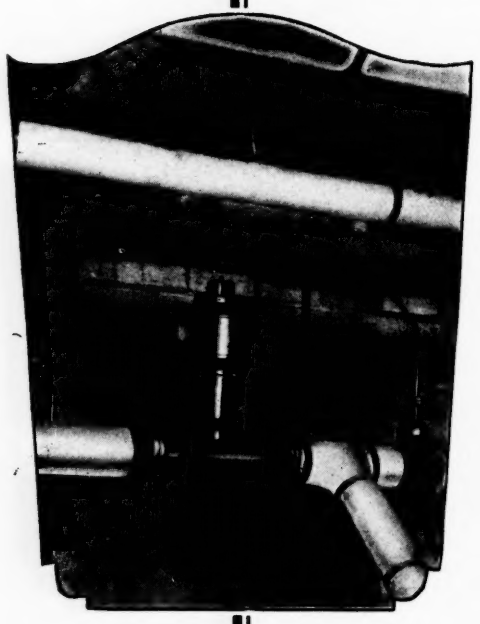
Write for Bulletins Nos. 22, 14 and 60

REPRESENTATIVES IN 40 CITIES OF U.S.A.

ILLINOIS ENGINEERING COMPANY

ROBT. L. GIFFORD President INCORPORATED 1900

CHICAGO



NOW...Make Real Friends and Real Profits Curing "Sick" Hot Water Jobs..

MID-WINTER is one of the best times of the year for *your* HYDROLATOR profits. You'll find the owners of "sick" hot water systems in a most receptive attitude toward the HYDROLATOR at this time . . . when they're cold and uncomfortable.

Forces Rapid Circulation

The HYDROLATOR, by means of a centrifugal pump, drives the water through the system several times faster than ordinary thermal circulation. Also, by means of an exclusive check valve feature, it overcomes traps and excessive pipe restrictions.

Saves Fuel

The HYDROLATOR saves enough fuel in one or two seasons to pay back to the owner its cost of installation.

Write for Bulletin 729-H

JANETTE MANUFACTURING CO.

558-60 West Monroe Street

CHICAGO

Distributors in Leading Cities

Singer Bldg. 149 Broadway New York

Real Estate Trust Bldg. Philadelphia

Specify and Use

E-Z RADIATOR HANGER

3 Styles for Any and All Conditions

Any wall or tube type radiator can be hung with one of the 3 styles of E-Z RADIATOR HANGERS. Only one bolt is necessary in wall for each hanger, and it does not have to be placed accurately as both height and lateral variations can be taken care of with the hangers. Easier, quicker and cheaper to install.

Style "C" Style "H" Style "R"

Recommended and used by leading architects and contractors throughout the U. S. and Canada. Write for complete information and prices.

Easy to Install

Healy-Ruff Company

772 Hampden Avenue ST. PAUL, MINN.

Also Manufacturers of E-Z INSERT

The ROCHESTER CIRCULATOR

means higher velocity on *every Hot Water Job!*

Perfection in equipment detail is the one way of assuring perfect results,—*every time,*—at less cost.

Full boiler temperature maintained evenly in every part of every radiator,—easy with the

ROCHESTER CIRCULATOR

New Jobs Cost Less Than Steam or Vapor,—*and Work Better*

For every Hot Water House Heating System from 1½" to 12" pipe size.

INVESTIGATE NOW!

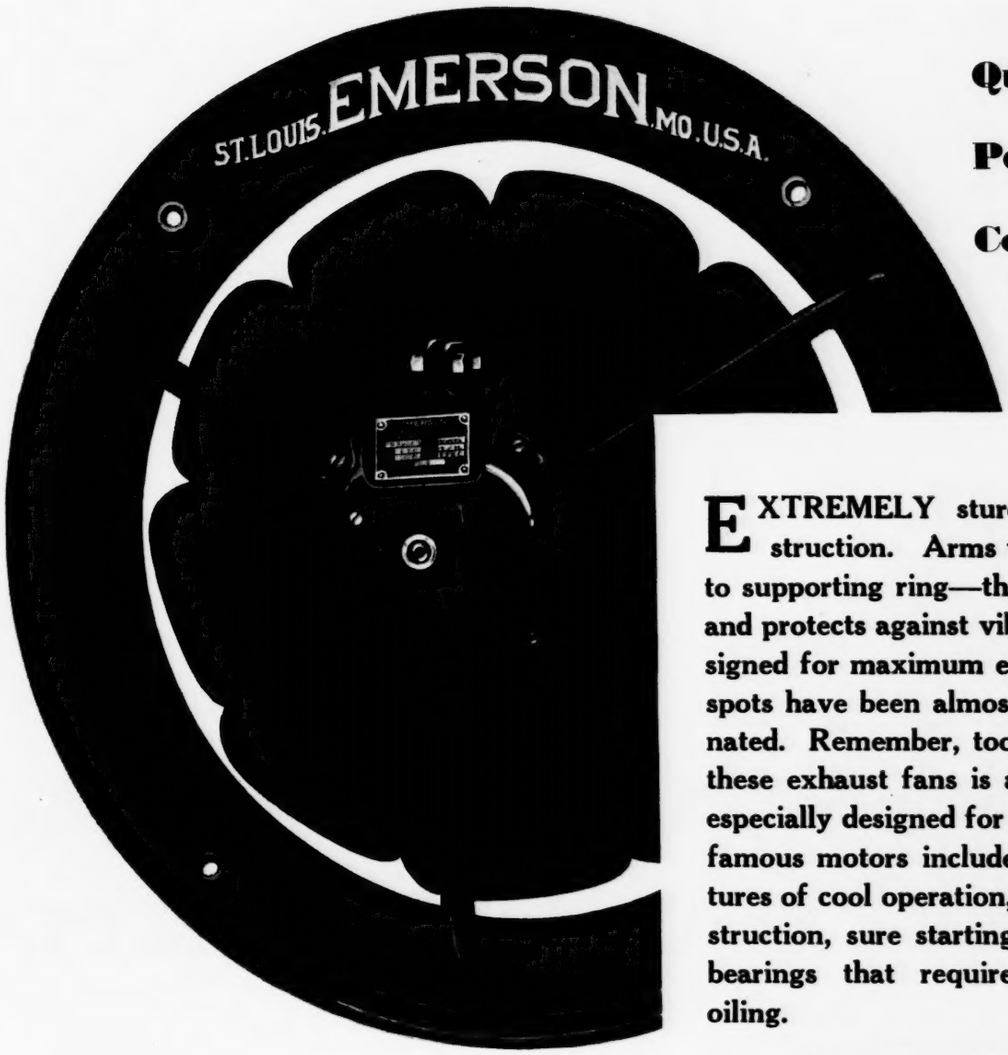
Write today for booklet,—"The Universal Fault of Hot Water Heating Systems and the Cure."

THE ROCHESTER CIRCULATOR CO.

P. O. BOX 23 ROCHESTER, N. Y.

A Line of Exhaust Fans

12 to 36 inches



Quiet

Powerful

Completely Dependable

EXTREMELY sturdy but light construction. Arms welded and riveted to supporting ring—this provides rigidity and protects against vibration. Blades designed for maximum efficiency. Dead air spots have been almost completely eliminated. Remember, too, that the heart of these exhaust fans is an Emerson Motor especially designed for fan service. These famous motors include the desirable features of cool operation, dust-resisting construction, sure starting and wool packed bearings that require only infrequent oiling.

May we send Bulletin 3519 containing full data?

THE EMERSON ELECTRIC MANUFACTURING CO.
2018 Washington Ave., Saint Louis
806 W. Washington Blvd., Chicago
155 Sixth Ave., New York City

EMERSON

EXHAUST FANS

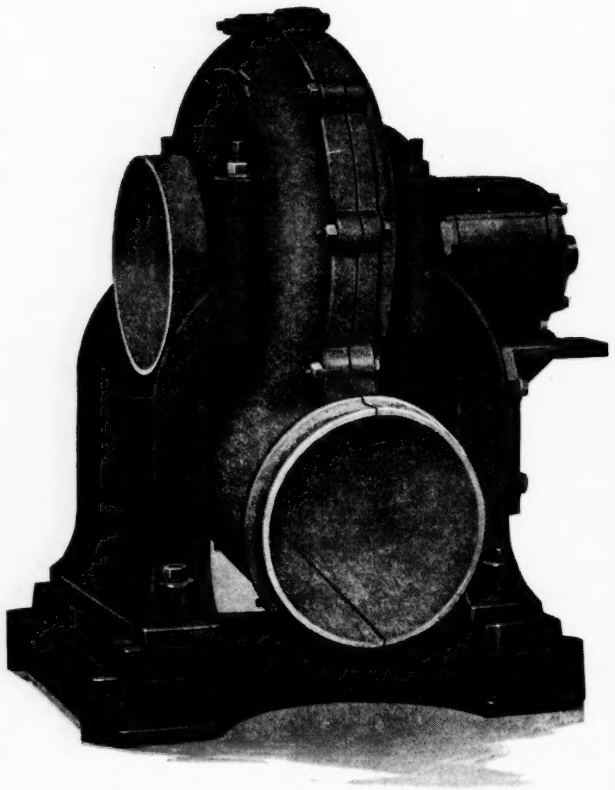
Made by the Makers of Emerson 1-30 to 2 h. p. motors

Q: Destructive Fumes?
A: Duriron Fans

FOR the situation where acid fumes must be exhausted there is a Duriron fan that will give service that cannot be equalled.

Duriron fans handle corrosive fumes as other fans handle pure air. They operate efficiently at high speeds without attention.

Duriron exhausters provide the permanent solution to acid fume problems.



Duriron fan No. 150-A. Maximum capacity 2200 cubic feet per minute. Furnished for any type of rotation and either belt or direct motor drive. Capacity tables of this and other sizes of Duriron fans given in Bulletin No. 158. Write for it.

THE DURIRON COMPANY, INC.
DAYTON, OHIO

A Division of The Industrial Alloy Products Corporation

DURIRON
FOR ACID SERVICE

THE KAINER PRESSURE GOVERNOR
The KAINER PRESSURE GOVERNOR
For Hot Water Heating Systems
Reduces the cost of a hot water layout.
Eliminates expansion tank and fittings (with its danger of freezing and overflowing).
Simplifies installation—makes a better job.
Saves your time and your customers' money.
Increases your profits and builds good will.
Write us for full information
KAINER & COMPANY CHICAGO
761-771 MATHER STREET
Manufacturers

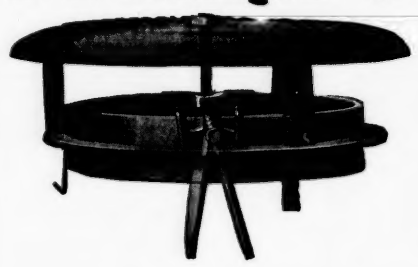
NATIONAL Control

includes thermostats for single or two-temperature control on direct radiation, air conditioning, blast or unit heating systems; humidity controls; firing and damper control for high pressure boilers; damper regulators for low pressure and hot water domestic heating boilers; and temperature control for hot water supply systems.

Write for descriptive literature covering your control requirements

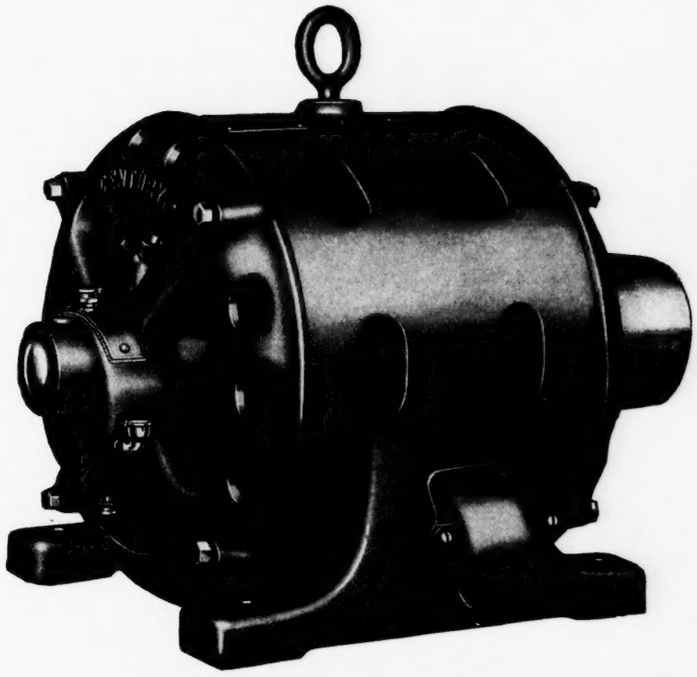
National Regulator Co., 2309 Knox Ave., Chicago, Ill.

E-Z Damper Grip-Tite Floor Vents



Positive Air Control at Floor Level

ÆOLUS DICKINSON
Industrial Division of Paul Dickinson
3340 S. Artesian Ave. CHICAGO, ILL.



5 Horse Power Century Type R S
Repulsion Start Induction Single Phase Motor

Century

Proved Reliability

For more than 25 years, Century Type RS Repulsion Start Induction Single Phase Motors have given daily proof of their reliability in all classes of service in all parts of the civilized world. They are widely used in installations requiring high starting torque, low starting current and continuity of operation—such as electric refrigerators, oil burners, pumps, compressors, and similar apparatus. The windings are thoroughly insulated and are then saturated with insulating varnish. This preserves the insulation and protects the windings. Dampness does not affect them.

Built in standard sizes from 1/8 to 40 horse power.

CENTURY ELECTRIC COMPANY
1806 Pine St. St. Louis, Mo.
40 U. S. and Canadian Stock Points and more than 75 outside thereof

Century MOTORS

"THEY KEEP A-RUNNING"

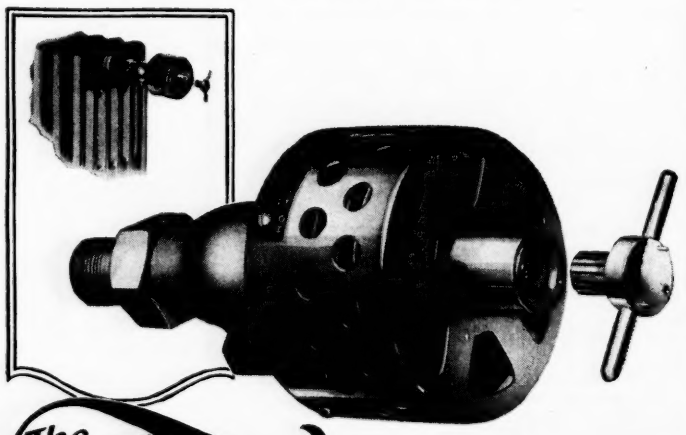
Almost 8 QUARTS in a qallon of oil!

DEPENDABLE economy of heating plant operation is the most interesting topic about which you can talk to building owners, hotel operating companies and leassors.

And *dependable economy* is the outstanding characteristic of the Thermotrol.

Dependable because it regulates room temperature accurately—economical because it saves that waste of fuel that is the result of thoughtless operation of uncontrolled heating. With the Thermotrol your customers can make one gallon of fuel oil or one ton of coal do the work of almost *two*.

Write for complete information.



The Thermotrol

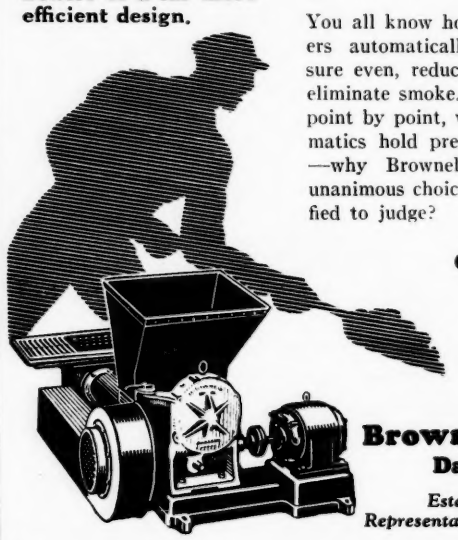
STERLING ENGINEERING COMPANY
1644 HOLTON STREET MILWAUKEE, WIS.
Representatives in principal cities

Again BROWNELL Sets the Pace

A builder of boilers back in the 50's, Brownell pioneered the majority of the major improvements in boiler design of the past 75 years.

And now Brownell is again pioneering—this time in stokerdom, with newer designs, sounder engineering, better selection of materials, finer craftsmanship. The world has yet to find a worthy substitute for seasoned experience.

Stokers for Heating Plants, Also Heating Boilers of a far more efficient design.



You all know how stokers fire boilers automatically, keep the pressure even, reduce coal wastage and eliminate smoke. But do you know, point by point, why Brownell Automatics hold present day leadership —why Brownells are the almost unanimous choice of men best qualified to judge?

Get Stoker Bulletin S-51
Heating Boiler Bulletin M-30

The Brownell Company
Dayton, Ohio
Established in 1855
Representatives in Principal Cities

SEAMLESS TUBING
LENGTHS AND COILS

"Extra Heavy" Tube for Oil Burner Installations. Special Tubing to order. Parts fabricated to specifications.

Send for Data and Prices

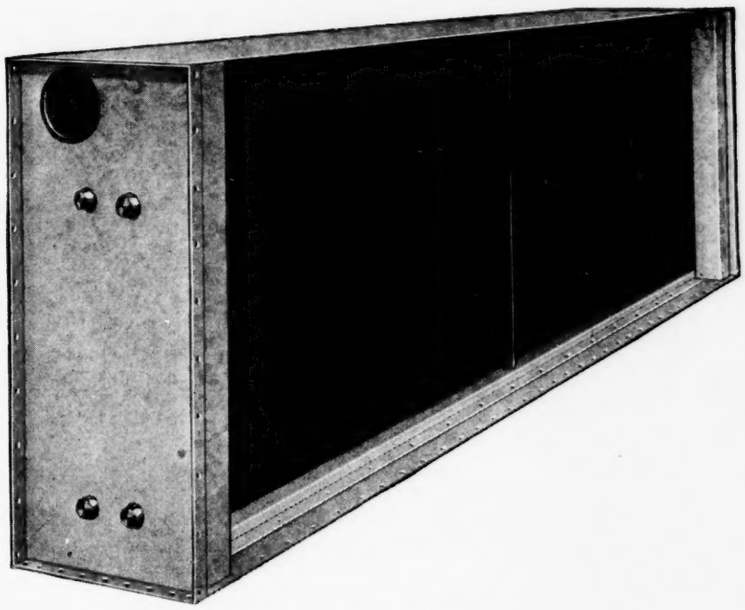
WOLVERINE TUBE CO.
SEAMLESS COPPER BRASS & ALUMINUM
1415 Central Ave. Detroit, Mich.

CHACE THERMOSTATIC METAL

"It bends with the heat"

A most accurate, consistent, and durable bi-metal for temperature responsive devices.
For Low and High Temperature Applications.
Type No. 1800 Bi-metal for temperatures 0 to 300 F.
Type No. 2600 Bi-metal (Patented) for temperatures 0 to 1500 F.
Type No. 2800 Bi-metal (Patented) for temperatures 0 to 1500 F.
Write for sample and description, giving as much information as possible regarding application.

Manufactured by
W. M. CHACE VALVE COMPANY
1600 Beard Ave., DETROIT, MICHIGAN



ARCOBLAST

ENCASED HEATERS

WHEN the Heating and Ventilating Apparatus is located overhead in Theatres, Auditoriums and other Public Buildings and the construction of the building will not permit additional weight then ENCASED ARCOBLAST should be selected by the HEATING ENGINEER.

The design of ENCASED ARCOBLAST having three-quarter inch copper tubes with spirally wound fins secured into specially shaped cast iron headers gives good THERMOSTATIC CONTROL.

The encasement is rigid and complete made of black sheet metal, galvanized after being made and left ready for pipe connections.

Built for STEAM PRESSURE from 5 to 200 pounds.

We will be glad to send you CATALOGUE giving complete information and engineering data.

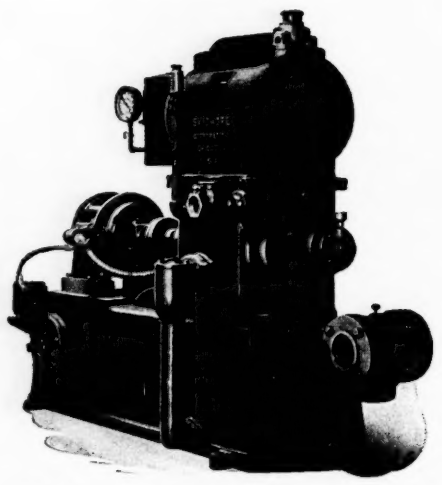
AMERICAN RADIATOR COMPANY

40 West 40th Street, New York City 816 South Michigan Avenue, Chicago

MAINTAINED-EFFICIENCY

Must be considered in buying a

VACUUM PUMP



Skidmore Automatic Vacuum Pump

Skidmore Vacuum Pumps have maintained efficiency because the vacuum producing rotor has very ample clearances, and for this reason wear due to core sand and scale from the system cannot lower the efficiency of the unit regardless of how long it has been installed.

Write for Bulletin No. 6

SKIDMORE CORPORATION, CHICAGO

Office and Factory—1535 Dayton St.

Representatives in Principal Cities

Canadian Representative: Darling Bros., Ltd., Montreal

DURABILITY an outstanding JOHNSTON FEATURE!

All seams or joints of Johnston Steel Heating Boilers are electric arc-welded. Staybolts and braces are welded in place. All plates are of firebox steel quality. Tubes are hot rolled seamless steel. Breeches, smokeboxes, firedoors and cleanout doors are all of steel; no cast iron is used in any part of the boiler proper.

The illustration shows the smokebox doors wide open. Notice the all steel construction. Light weight and non-cracking. No trouble to thoroughly clean every tube.

Write for copy of catalog H-300 illustrating and describing Johnston Steel Heating Boilers

JOHNSTON BROTHERS, Inc., Ferrysburg, Mich.

22 *empty apartments . . .*

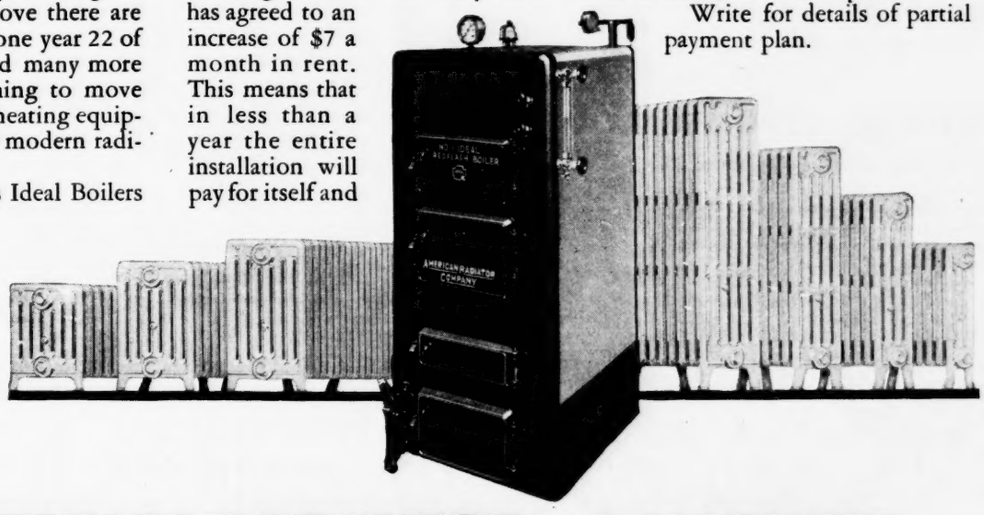
AMERICAN RADIATOR WARMTH rented them all *and gave the landlord* $735 A MONTH BESIDES

HERE is a true story that tells why American Radiator warmth is one of the greatest sales influences that you can add to any building. In the two buildings above there are 105 apartments. For one year 22 of them were vacant and many more tenants were threatening to move unless old-fashioned heating equipment was replaced by modern radiator warmth.

In both apartments Ideal Boilers and American Corto Radiation were installed at a total cost of $16,000. Today every apartment in both buildings is rented and every tenant has agreed to an increase of $7 a month in rent. This means that in less than a year the entire installation will pay for itself and the landlord will continue to get an increased income of $735 every month.

An "All-American" job is a real investment, not an expense.

Write for details of partial payment plan.



AMERICAN RADIATOR COMPANY

40 WEST 40TH STREET, NEW YORK

Division of

AMERICAN RADIATOR & STANDARD SANITARY CORPORATION

S & K FUEL OIL BURNERS

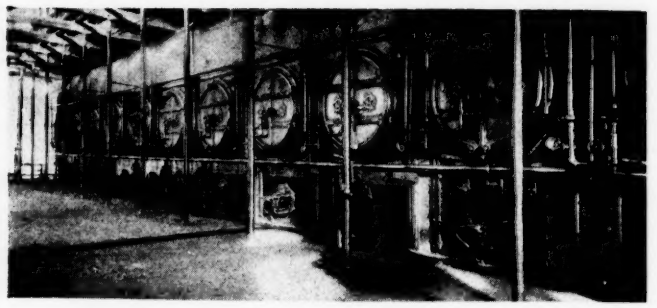
are backed by years of experience

Mechanical types, natural or forced draft, for boilers. Special types for industrial stills and furnaces.

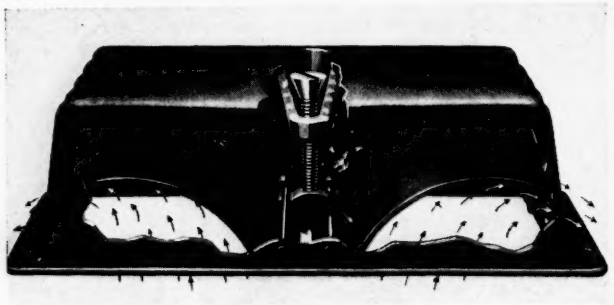
Bulletins 16-OA & 16-OG contain useful data.

SCHUTTE KERTING

1153 Thompson St.,
PHILADELPHIA, PA.



S & K Oil Burners on 11 200 H.P. Robb Boilers



Pat. No. 1704661

'TIS AN ILL WIND

that blows about in theatres, assembly halls and auditoriums equipped with ventilating systems designed with improper air distribution. An installation of the

ENFLO DIFFUSER

will not only insure proper air distribution, but will present many advantages which have been recognized by architects and engineers, such as cast iron construction, operation of both dampers by one concealed screw, diffusion of air along the floor line by twin curved dampers and the economy of its installation on any type of floor.

Write for Illustrated Catalog.

VENTILATING PRODUCTS CO.

2800 Cottage Grove Ave., Chicago, Ill.

RESULTS — — —

Results have built our business. The faculty for analyzing a given problem in heat transfer, and then to design and manufacture the one type of equipment most fitted to solve that problem, has brought results for our customers which have created an ever-widening circle of friends and a constantly increasing volume of business. If you want results, write us outlining your problem.

O. E. FRANK HEATER & ENGINEERING CO., Inc.

HEATERS COOLERS
RECLAIMERS EXCHANGERS
CONDENSERS

20 Milburn Street
Buffalo, N. Y.

OEF BUFFALO Olive E. Frank

WATTS DIAPHRAGM RELIEF VALVE TYPE 28

Especially designed to relieve excessive pressure on domestic range boilers and storage tanks. Bronze body and diaphragm—genuine Jenkins disc. Valve cannot clog or foul.

Approved by Underwriters' Laboratories.

WATTS REGULATOR CO.
253 LOWELL ST.
LAWRENCE, MASSACHUSETTS
Sales Associates
John G. Kelly, Inc., 210 E. 45th St., N. Y. C

United States Ozone Company of America

Trade Mark USOZONE Reg. U.S. Pat. Office

Manufacturers and Engineers
ESTABLISHED 1910

U. S. VENTILATING OZONIZERS
U. S. WATER OZONIZERS
U. S. INDUSTRIAL OZONIZERS

Trade Mark USOZONE Reg. U.S. Pat. Office

Ask for copy of

Bulletin 41—Ozone and Its Production. Bulletin 54—The Functions of Ozone in Ventilation.
Bulletin 55—The Function of Ozone in Water Purification.

Factory and Sales Office: SCOTTDALE, PENNA.

ROME HELICALFIN TUBES

For Lower Heating Costs

Years of engineering research have provided in Rome HELICALFIN Tubes qualities which make them the ideal medium for heat transfer work. Sturdily constructed of seamless cold drawn copper tubes equipped with flat continuous copper radiating fins, they present the highest efficiency with low air resistance.

There is a size of Rome HELICALFIN Tubes for all—

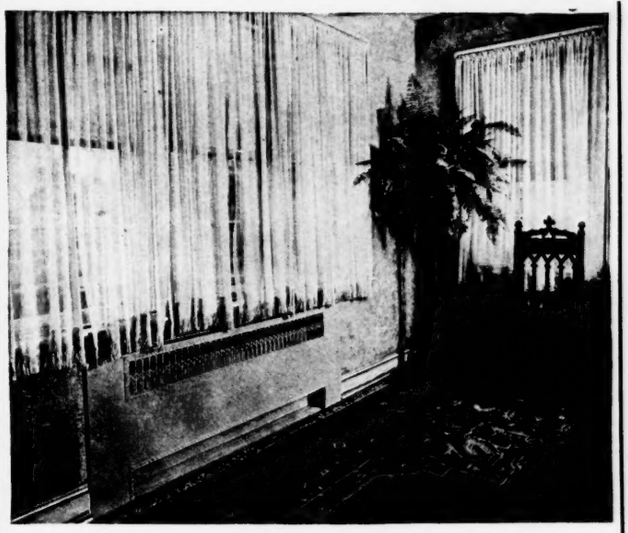
Unit Heaters
Fan System Heaters
Concealed Radiation

There are no corrugations in the fin to catch and hold the dirt.

Engineering data on request.

SPECIFY ROME QUALITY

ROME-TURNEY RADIATOR COMPANY
ROME NEW YORK
The Copper City



FINTUBE

"The Modern Heating Unit"

For STEAM, VAPOR, VACUUM, and HOT WATER HEATING

Seamless hard drawn copper tubing. Copper fins are an integral part of tube. No welding, soldering, or tinning in any part of FINTUBE.

Leak-proof. Will last a lifetime. Easily cleaned with vacuum cleaner. Completely concealed within the walls.

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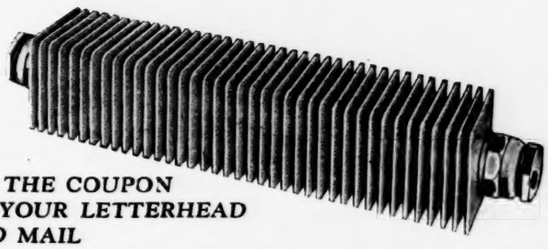

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Please send without obligation a copy of your FINTUBE Catalog and other details regarding FINTUBE.

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leave silence on the job as well as safety. They may be used with success on the prominent patented vapor, vacuum, atmospheric and modulation systems.

Send for our Bulletin 16 Giving full Details.

LIFE EXTENSION

for boilers is guaranteed by rigid maintenance of the proper water level.

These dependable devices return all water of condensation, preventing air bound or water logged conditions and resulting burning or cracking of the boilers.

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The Thermo Syphon Trap safeguards all types of vapor and atmospheric heating systems .....

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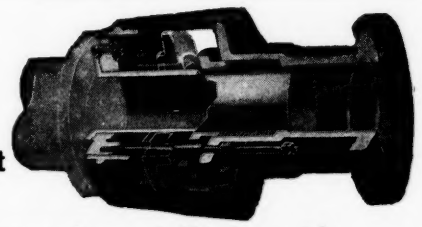
HEATING *and* VENTILATING

Classified Advertising

is especially recommended for the attention of the manufacturers in the Industry who are desirous of meeting men of proven calibre and experience in their field.

ON PAGE 138 IN THIS ISSUE

ROSS Crosshead-GUIDED Expansion Joint Excels in



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that we want every Heating and Ventilating Engineer to keep a copy of this Atlas Junior Catalog No. 21 in his files? That is exactly what we want. Check off those items below in which you are interested, mail to us, and you will receive this catalog, prices and whatever you may need in the way of information on any Atlas product.

☐ Reducing Valves ☐ Float Valves
☐ Temperature Regulators ☐ Swing Joint Fittings
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ATLAS VALVE COMPANY
REGULATING VALVES FOR EVERY SERVICE
281 South Street, Newark, N. J.

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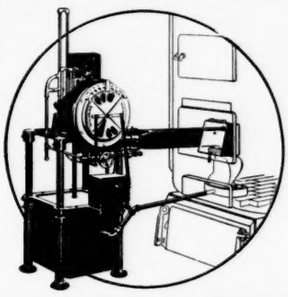
Listed as standard by Underwriters
Approved by New York Board of Standards and Appeals

No Gas Pilot



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Continuous Flame Automatically Governed

The McIlvaine is scientifically correct in principle, design and construction. It is quiet, clean, dependable. Its continuous flame, mechanical draft and graduated control insure continuous, even heat, with the highest efficiency—greatest economy—freedom from odors and trouble. The only flame is the oil flame. There is no gas pilot to blow out—no electric spark to fail—no intricate starting and stopping devices to get out of order—no trouble from delayed ignition. There is no waste through alternately forcing the heating system, then cooling it off again.

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Unit Heaters

When the heating equipment you propose to use on your job has a record of thousands of successful installations behind it, you can rely upon it to be just as successful on yours. ¶ New York Blower Products have certified ratings and a durability record that is beyond question.

For descriptive literature write to 3151 Shields Avenue, Chicago.

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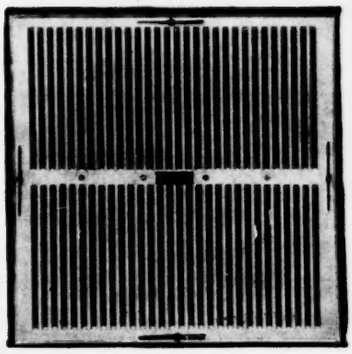
How New York could save $16,000,000 a year

The National Conference Board on Sanitation has estimated that it costs the City of New York $16,000,000 annually to clean and redecorate the interiors of buildings damaged by smoke and soot.

Add to this the additional enormous loss caused by dust, and by sickness and loss of life due to disease germs carried by dust and soot, and you will realize the importance of cleaning air before it goes into buildings. Most of this money loss and suffering can be prevented by installing the

PROTECTOMOTOR
REG. U. S. PAT. OFF.
Perfect Positive Protection
PANEL AIR FILTER



The Protectomotor removes 999 of every 1,000 particles of dust, dirt and soot from air.

Its first cost is low, and it costs practically nothing for operation, as no oil drains or cleaning tanks are needed. Accumulated dust and dirt can be removed from the filter in about one-half minute per panel with our special vacuum cleaner, and cleaning is only necessary about every two months.

Protectomotor Air Filter maintains the resistance below any specific pressure drop.

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VECO SYSTEM of VAPOR HEATING

An "Open to atmosphere" System.
The original and standard method of
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VAPOR ENGINEERING COMPANY

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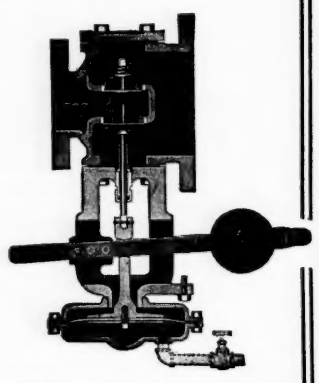
Efficiency

always out-earns its cost

Because Kieley Steam, Water, Air, Gas and Oil Specialties are efficient... because they eliminate leakage ... are easily accessible ... because they hold records for endurance and dependability, there is no doubt in the fact that they soon *out-earn their costs.*

Every Kieley & Mueller product has been developed slowly and can be depended on to be absolutely safe for the service intended.



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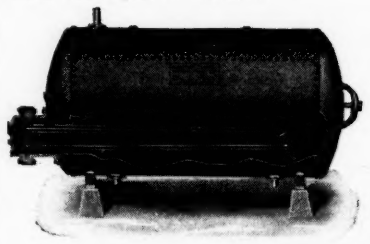
Alberger Buffalo Heaters

are built for a great variety of standard and special operating conditions for heating water with steam or for the interchange of heat from one liquid to another.



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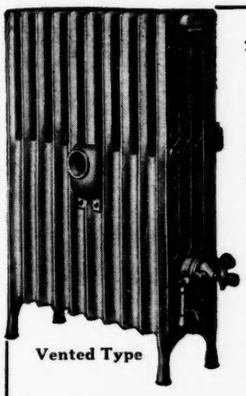
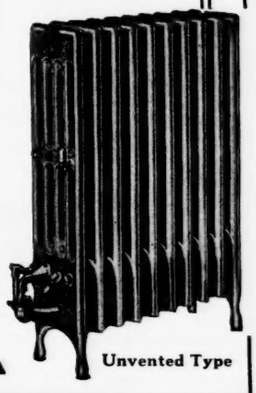

Vented Type

Pittsburgh Automatic Gas Steam Radiators were designed primarily to meet the demands of those thoroughly familiar with heating systems, — who appreciate automatically controlled steam heat when they want it and where they want it without inconvenience, dirt, boiler or labor.

Pittsburgh Automatic Gas Steam Radiators

are available in both the vented and unvented types. The flue type has the advantage of creating forced ventilation through the radiator into the flue outlet.


Unvented Type

AUTOMATIC GAS STEAM RADIATOR CO.
301 BRUSHTON AVENUE,
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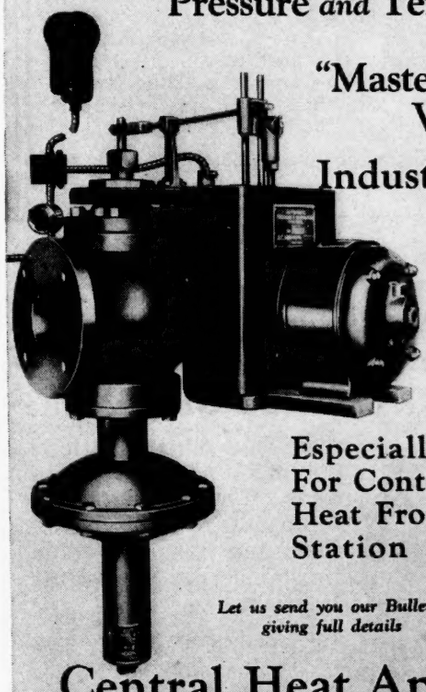
HORNUNG
Pressure *and* Temperature
2 *in* 1
"Master Control" Valve
(PATENTED)
Industrial Type



Motor Operated Directly by Thermostat

All Relays Eliminated ... ...

Especially Designed For Control of Steam Heat From a Central Station

Let us send you our Bulletin giving full details

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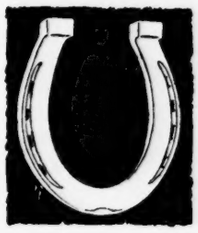

Burnham Boilers

There's a Lucky Loop in Every Burnham

That "S" shaped fire travel goes a horse shoe one better as a luck catcher. Its double bend gets the heat going and coming. And after all that's what your customers ask in a boiler.

It's profitable to give your customers what they want. So why not look up this Burnham loop, and let it put money in your pocket?

Write for descriptions, ratings and prices.

Burnham Boiler Corporation
IRVINGTON, NEW YORK
Representatives in all principal Cities of the United States and Canada

A GOOD BOILER RETURN TRAP will provide the simplest and best means of returning condensation to an ordinary steam heating boiler where equipment has little or no attention.

A cheap trap of ordinary construction will sooner or later fail — a broken boiler—that's all.

The Simplex "Valve in the Head" trap with bronze and nickel steel valves and working parts is a distinctly superior piece of equipment built for lifetime service.

Send us your next order, pay the small difference and let experience be your guide.

SIMPLEX HEATING SPECIALTY CO., Inc.
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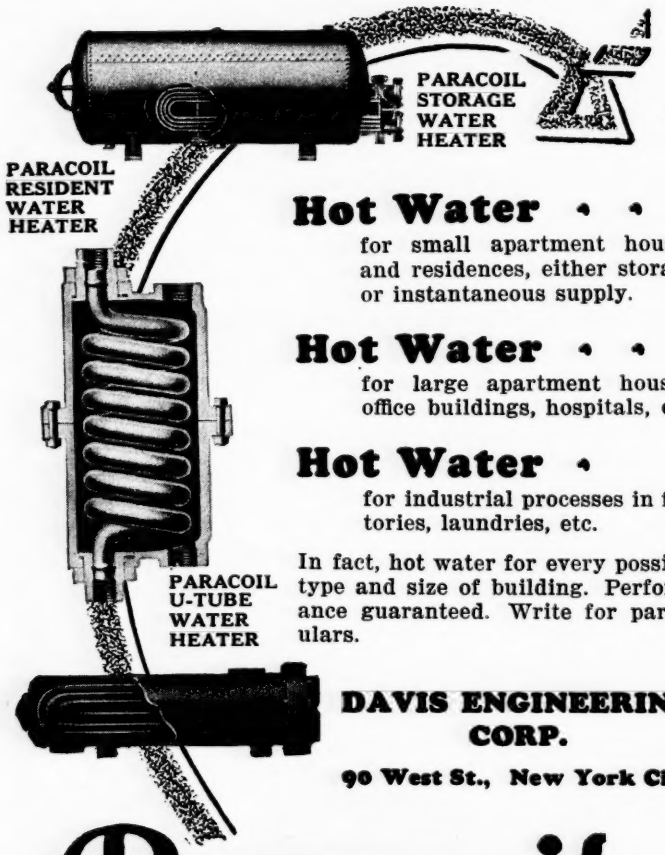

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for small apartment houses and residences, either storage or instantaneous supply.

Hot Water • •
for large apartment houses, office buildings, hospitals, etc.

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for industrial processes in factories, laundries, etc.

In fact, hot water for every possible type and size of building. Performance guaranteed. Write for particulars.

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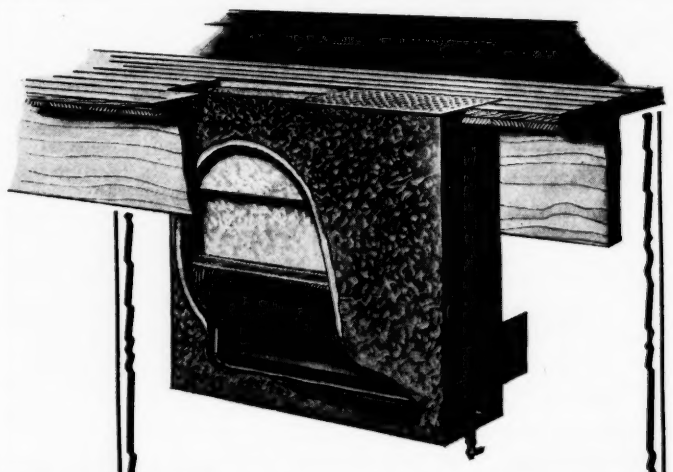
Paracoil
WATER HEATERS



The Thermoist Unit

A sturdily constructed unit, simple in operation and very easily installed in either a new or an old residence.

The humidity is supplied automatically as it is required. It can be closely regulated but needs no adjustment after installation. The heat is controlled by a damper operated from the grille. Everything is contained in a single compact unit concealed under the floor.

The last word in comfort and health for the home.

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Valve Area *vs.* Free Passageway

In the ordinary radiator valve the disc and holder form an obstruction which prevents free flow in opposite directions through the valve.

THE GORTON QUARTER TURN PACKING LOCK RADIATOR VALVE
permits steam and water of condensation to flow freely in opposite directions, allowing the radiator to be vented eight times faster than with the ordinary valve. Be sure to investigate the

GORTON SINGLE PIPE VAPOR HEATING SYSTEM
Manufactured and Guaranteed by
GORTON HEATING CORPORATION
96 Liberty Street *Established 1887* New York City

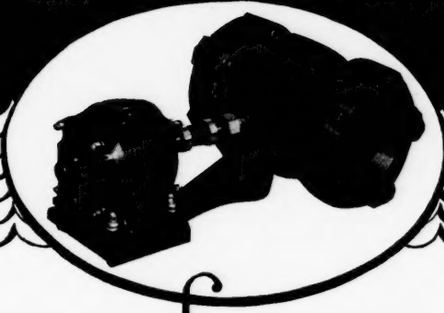
New STAT-AMATIC CATALOG

Tells how Stat-Amatic is solving unlimited problems of heat control and temperature regulation including its great value in connection with Unit Heaters.

You should have this catalog HV2.

Stat-Amatic Intrument & Appliance Co.
HARTFORD, CONN.

The Compeller
FOR HOT WATER HEATING SYSTEMS



for
sluggish
hot water
heating systems

WHEN rooms won't heat as they should — when any amount of *firing* seems to make no difference in *heat,* it's usually *poor circulation.*

In old hot water systems where scale has reduced effective pipe sizes—or where an enlarged house must be heated from an existing hot water system — use the compeller for positive circulation.

It will *get action.* Rapid circulation means rapid heat transfer—and that means quicker heating, more effective control and noticeable economies in fuel.

In new systems, contractors are finding that pipe sizes may be safely reduced when the Compeller is used —and that's another economy.

The Compeller is simple and dependable. It is easy to install and certain in results. Write for full particulars.

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APPROVED BY THE UNDERWRITERS' LABORATORIES

For Hot Water House Heating Systems

ELIMINATES EXPANSION TANK

Chosen by those who prefer greater Efficiency, Economy, Automatic Control and Safety in Operation.

Ask your jobber, and write us for Catalog No. 34

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BALL COCKS
INDIRECT HEATERS
GAS WATER HEATERS
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STACK PRODUCTS

RELIEF VALVES
NO-TANK VALVES
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PRESSURE REDUCING VALVES

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New Prices

KNOWLTON WATERTUBE STEEL BOILERS

Lower Sept. 20th

Perfect Performance
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A NEW STANDARD OF ECONOMY!

Fairbanks Bronze Globe Valves

Globe and Angle Pattern

Fig. .01

The interchangeable and renewable features of Fairbanks Valves present greater economy in these high grade valves than can be obtained by the use of the cheapest valves on the market.

Available for Steam or Water Service for 150 lbs. Steam Working and 200 lbs. Water Working Pressure.

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Factory: Binghamton, N. Y.

Distribution in All Principal Cities

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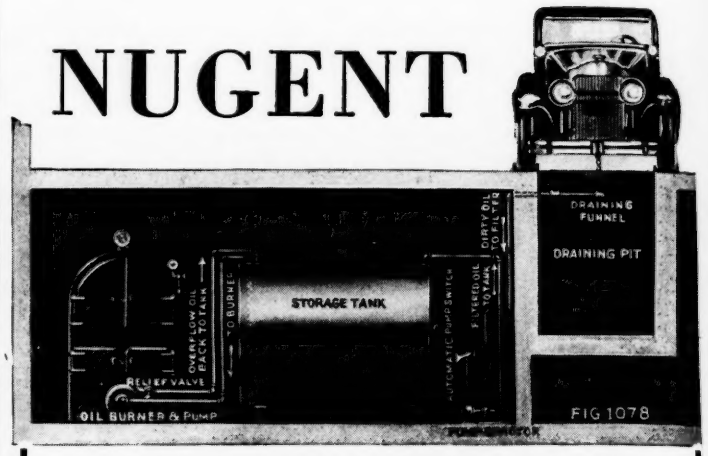
NUGENT



Seventy Thousand Garages

are doing an active business in this country, —nearly one third of that number handle sufficient crank-case oil to utilize for heating fuel.

Heat Without Cost

The Nugent Crank Case Fuel Oil Filter operates automatically in accordance with the demands of the burner. The waste crank-case oil is prepared and utilized at practically no cost. There is an excellent opportunity for dealers to sell this filtering equipment as well as oil burners to garages.

Write Today For Details

Wm. W. Nugent and Company

409 North Hermitage Ave., CHICAGO, ILL.

Twice the Strength and Half the Weight of Cast Iron

AEROVALVE Steel

MUSHROOM AIR DIFFUSER

Every industry has replaced cast-iron equipment with steel. Why lag behind? Cast-iron looks strong but it isn't. Aerovalve Mushrooms, made of durable rolled steel, are UNBREAKABLE. Being much lighter than cast-iron, they are easier to handle and more quickly installed. And finally, they cost less!

Other interesting features described in folder. Write for it.

Knowles Mushroom Ventilator Co.

Originators of the Mushroom and makers of the "Nu-Notch" Mushroom and "Disc-Loc" Gallery Riser Vents.

41 No. Moore St. NEW YORK CITY

One of McAlear's many products
SUCTION STRAINER
No. 528

McALEAR

Sensitive—accurate—simply constructed. Pressure and Level Control Equipment. Write for catalogue

THE McALEAR MFG. CO.

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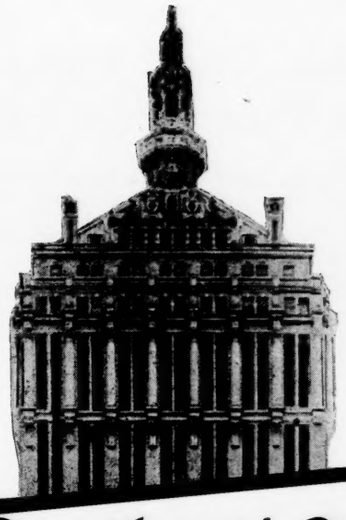
DETROIT, MICHIGAN

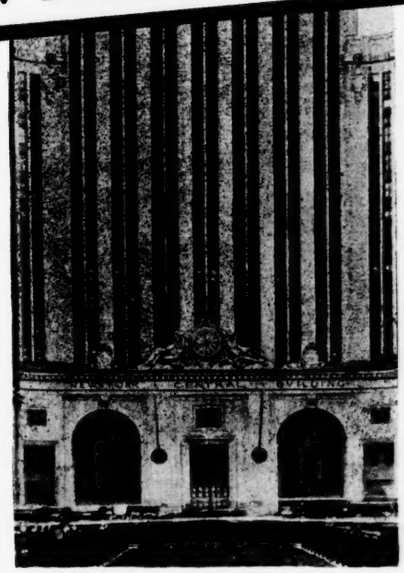
MANUFACTURERS OF

Cadillac Condensation Meters
Detroit Feed Water Meters

Packingless Expansion Joints and other special fittings for underground steam distribution mains.



Patterson
Hot Water Heaters Serve the New York Central Bldg.



New York Central Building, New York
Warren & Wetmore, Architects
James Stewart & Co., General Contractors
James McCullagh, Plumbing Contractor
Alvord & Swift, Heating Contractors

This 35-story building, with 45,000 sq. ft. of floor space on the lower floors and a road for vehicular traffic running right through the building, is another triumph in building wonders.

To insure tenants of a bountiful supply of clean hot water this beautiful building is equipped with Patterson Indestructo Hot Water Heaters and Patterson Heat Exchangers.

These heaters are lined throughout with copper. That insures clean hot water, free from rust. It prevents rust eating holes in the metal and makes the heaters practically everlasting.

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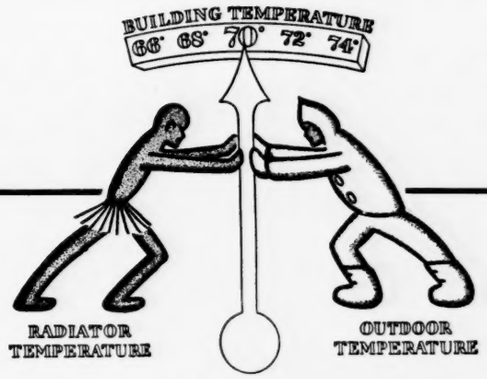
THE PATTERSON-KELLEY CO.
107 East 40th St., New York, N. Y.



Stops "Overheating"
with its waste of fuel

For every outdoor temperature there is a corresponding radiator temperature that will properly heat a building. A Raymond Duo-Stat *"teams them up"* and uses them to control the heating plant. So the **radiators always get the exact amount of heat needed according to the weather.**

Radiators never get too hot, nor stone cold. Complaints about cold radiators cease—and tenants never need to open windows to cool off, wasting good fuel.

THE RAYMOND
DUO-STAT

for Oil or Gas Burners, or Coal Stokers

for Steam, Vacuum, Vapor and Hot Water Systems

It's impossible to accurately regulate the temperature of any building without considering *both* radiator and outside temperatures. **Yet the Duo-Stat is the only device that does it.**

Just one Duo-Stat controls an entire building, keeping every radiator on the system at the same comfortable temperature. No special heating lay-out is required. It's as simple to install as a room thermostat, and the total cost is very low.

WRITE for complete data and discounts, including a profusely illustrated Instruction Booklet with complete wiring diagrams for all types of installations

F. I. RAYMOND CO.
BUILDERS BUILDING
228 North La Salle Street
CHICAGO

Comparative

Installation and Operating Costs of SUNNYAIRE

Gas Fired Unit Heaters vs. Steam Equipment

Show a saving of better than twenty-five percent in original cost and this without including the cost of a boiler room and stack, which would make the savings twenty percent greater.

The yearly maintenance charges on the "SUNNYAIRE" is running less than one percent.

The "SUNNYAIRE" Gas-fired Unit Heater is a self contained Heat Generating Unit, suspended from the ceiling or roof trusses making all floor space available for productive use.

Below, is shown the interior of the Metal Aircraft Corp. Bldg., Cincinnati, O., heated by "Sunnyaire" gas-fired unit heaters, using 385 cu. ft. of 900 B.t.u. mixed gas per hour and having a total heat delivery of approximately 2,100,000 B.t.u. Offices heated by "Sunnyaire" Heat Cabinets.

Comparative Costs:— Steam $14000.00 without Boiler Room and Stack. Total cost gas equipment, $9300.00.

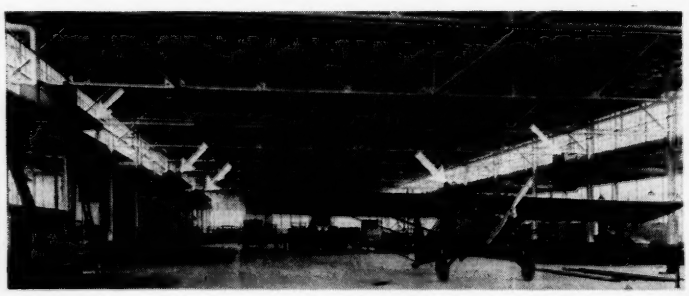
Ask us how "SUNNYAIRE" equipment with its thousands of dollars in savings can be applied to your plant.

TEXO HEATER & MFG. CORP.

(*formerly* TEXO SALES COMPANY, *Inc.*)

Originators of gas fired unit heaters

220-230 MADISON AVE. COVINGTON, KY.



Books That Help You Save Time and Money

A. S. H. and V. E. Guide 1930

Every reader should have a copy of this standard reference book. It is revised annually and brought right up to date. The 1930 Edition has three new chapters and gives the very latest engineering data and manufacturers' notices so completely indexed you can locate any item at a glance.

CONTENTS BY CHAPTERS: 1. Codes and Standards; 2. Heat Losses from Buildings; 3. Standards of Ventilation; 4. Ventilating Systems; 5. Heating with Warm-Air Furnaces by Gravity; 6. Heating with Warm-Air Furnaces by Fan Pressure; 7. Air Conditioning and Cooling; 8. Air Cleaners; 9. Unit Heaters and Air Conditioners; 10. Heating by Coal; 11. Heating by Gas; 12. Heating by Oil; 13. Heating by Electricity; 14. Chimneys; 15. Boilers; 16. Conductors and Convectors for Steam and Hot Water Heating; 17. Automatic Heat Control; 18. Pipe and Fittings; 19. Pumps and Traps; 20. Piping for Steam Heating Systems; 21. Piping for Hot Water Heating Systems; 22. Piping and Equipment for Laundries, Kitchen and Hospital Service; 23. Water Supply Piping for Buildings; 24. Heat Insulation for Pipes and Surfaces; 25. District Heating; 26. Selection of Fans and Motive Power; 27. Air Ducts; 28. Pneumatic Exhaust Systems; 29. Drying by Evaporation; 30. Ozone and Ventilation; 31. Notes on Requirements for Special Types of Buildings and Service; 32. Specifications; 33. Physical Properties, Weights, Measures, etc.; 34. Symbols.

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Mechanics of Heating and Ventilating

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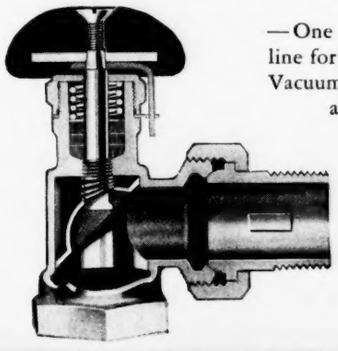

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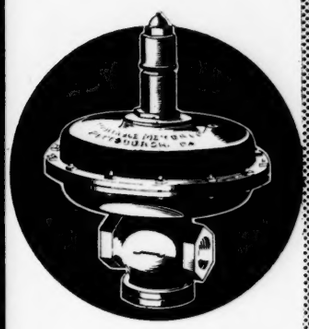

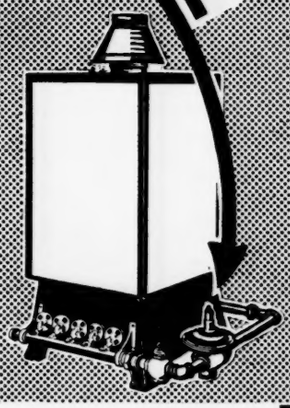

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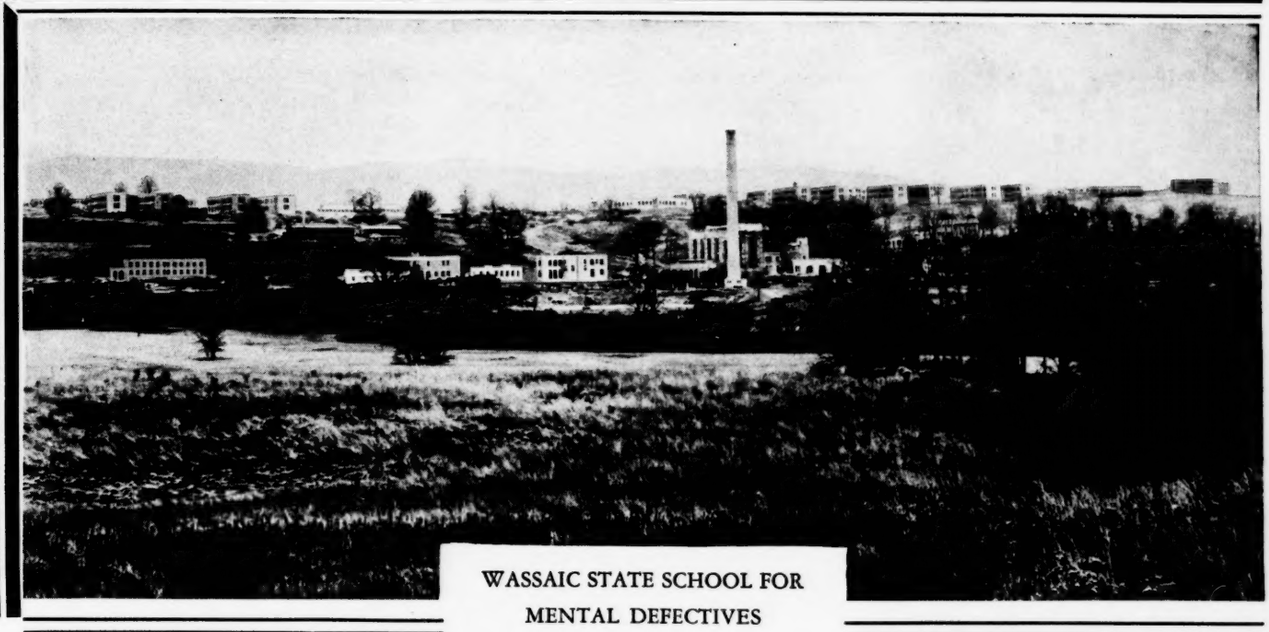

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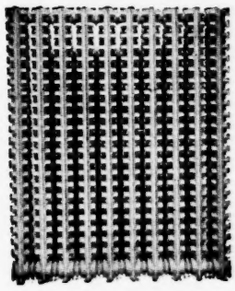

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The Stack Heater Co., Boston, Mass.
Walworth Co., New York.

GENERATOR COOLING SYSTEMS

American Blower Co., Detroit, Mich.
Bayley Blower Co., Milwaukee, Wis.
Bishop & Babcock Sales Co., Cleveland, Ohio.
Buffalo Forge Co., Buffalo, N. Y.
Reed Air Filter Co., Louisville, Ky.
Schutte & Koerting Co., Philadelphia, Pa.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.

GOVERNORS (PUMP)

Atlas Valve Co., Newark, N. J.
Bishop & Babcock Sales Co., Cleveland Ohio.
Crane Co., Chicago, Ill.
Dunham Co., C. A., Chicago, Ill.
Kieley & Mueller, Inc., New York.
Marsh & Co., Jas. P., Chicago, Ill.
Watts Regulator Co., Lawrence, Mass.
Webster & Co., Warren, Camden, N. J

GRATES, DUMPING

Fitzgibbons Boiler Co., Inc., New York.
Kewanee Boiler Corp., Kewanee, Ill.
Stanwood Corp., Cincinnati, Ohio.

GRATES, ROCKING

Kewanee Boiler Corp., Kewanee, Ill.
Page Boiler Co., Wm. H., New York.
Stanwood Corp., Cincinnati, Ohio.

GRATES, SHAKING

Fitzgibbons Boiler Co., Inc., New York.
Kewanee Boiler Corp., Kewanee, Ill.
Page Boiler Co., Wm. H., New York.
Stanwood Corp., Cincinnati Ohio.

GRATES, SHAKING AND DUMPING

Frost Mfg. Co., Galesburg, Ill.
Kewanee Boiler Corp., Kewanee, Ill.
Stanwood Corp., Cincinnati, Ohio.

GRATES, SHAKING, CIRCULAR

Fitzgibbons Boiler Co., Inc., New York.

GRATES, STATIONARY

Fitzgibbons Boiler Co., Inc., New York.
Frost Mfg. Co., Galesburg, Ill.
Stanwood Corp., Cincinnati, Ohio.

HEAT CABINETS

(See Radiators, Cabinet and Concealed)

HEATERS, AIR, FAN SYSTEM

Aerofin Corp., Newark, N. J.
American Blower Co., Detroit, Mich.
Bayley Blower Co., Milwaukee, Wis.
Bishop & Babcock Sales Co., Cleveland, Ohio.
Buffalo Forge Co., Buffalo, N. Y.
Dwyer Equipment Co., Chicago, Ill.
Modine Mfg. Co., Racine, Wis.
National Air Filter Co., Chicago, Ill.
New York Blower Co., Chicago, Ill.
Rome-Turney Radiator Co., Rome, N. Y.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.
Thermal Units Co., Chicago, Ill.
Trane Co., The, LaCrosse, Wis.
Wing Mfg. Co., L. J., New York.
Young Radiator Co., Racine, Wis.

HEATERS, DOMESTIC WATER

Alberger Heater Co., Buffalo, N. Y.
American District Steam Co., North Tonawanda, N. Y.
American Radiator Co., Buffalo, N. Y.
Crane Co., Chicago, Ill.
Davis Engineering Corp., New York.
Foster Wheeler Corp., New York.
Frank Heater & Engineering Co., O. E., Buffalo, N. Y.
Illinois Malleable Iron Co., Chicago, Ill.
Kewanee Boiler Corp., Kewanee, Ill.
Modine Mfg. Co., Racine, Wis.
Monitor Boiler Co., Philadelphia, Pa.
Page Boiler Co., Wm. H., New York.
Patterson-Kelley Co., New York.
Ross Heater & Mfg. Co., Buffalo, N. Y.
The Stack Heater Co., Boston, Mass.
Weil-McLain Co., Chicago, Ill.
Whitlock Coil Pipe Co., Hartford, Conn

HEATERS, ELECTRICAL UNIT

American Blower Co., Detroit, Mich.

HEATERS, FEED WATER, (CLOSED)

Alberger Heater Co., Buffalo, N. Y.
Davis Engineering Corp., New York.
Foster Wheeler Corp., New York.
Frank Heater & Engineering Co., O. E., Buffalo, N. Y.
Frost Mfg. Co., Galesburg, Ill.
Illinois Malleable Iron Co., Chicago, Ill.
Patterson-Kelley Co., New York.
Ross Heater & Mfg. Co., Buffalo, N. Y.
Schutte & Koerting Co., Philadelphia, Pa.
Stanwood Corp., Cincinnati, Ohio.
The Stack Heater Co., Boston, Mass.
Watts Regulator Co., Lawrence, Mass.
Whitlock Coil Pipe Co., Hartford, Conn.

HEATERS, FEED WATER (OPEN)

Frost Mfg. Co., Galesburg, Ill.
Stanwood Corp., Cincinnati, Ohio.

HEATERS, FUEL-OIL

Alberger Heater Co., Buffalo, N. Y.
Davis Engineering Corp., New York.
Electrol, Inc., St. Louis, Mo.
Frank Heater & Engineering Co., O. E., Buffalo, N. Y.
National Air Filter Co., Chicago, Ill.
Patterson-Kelley Co., New York.
Ross Heater & Mfg. Co., Buffalo, N. Y.
Schutte & Koerting Co., Philadelphia, Pa.
The Stack Heater Co., Boston, Mass.
Whitlock Coil Pipe Co., Hartford, Conn.

HEATERS, UNIT

Air-Way Electric Appliance Corp., Toledo, Ohio.
American Blower Co., Detroit, Mich.
Bayley Blower Co., Milwaukee, Wis.
Bishop & Babcock Sales Co., Cleveland, Ohio.
Buffalo Forge Co., Buffalo, N. Y.
Dwyer Equipment Co., Chicago, Ill.
McQuay Radiator Corp., Chicago, Ill.
Modine Mfg. Co., Racine, Wis
Nelson Corp., Herman, The, Moline, Ill
New York Blower Co., Chicago, Ill.
Peerless Unit Ventilation Co., Inc., Bridgeport, Conn.
Skinner Bros. Mfg. Co., St. Louis, Mo
Sturtevant Co., B. F., Hyde Park, Boston, Mass.
Thermal Units Co., Chicago, Ill.
Trane Co., The, LaCrosse, Wis
Wing Mfg. Co., L. J New York
Wolverine Tube Co., Detroit, Mich.
York Heating & Ventilating Corp., Philadelphia, Pa
Young Radiator Co., Racine, Wis

HEATERS, UNIT GAS FIRED

General Gas Light Co., Kalamazoo, Mich.
Texo Heater & Mfg. Co., Covington, Ky.

HEATING SYSTEMS, GAS

Roberts-Gordon Appliance Co., Buffalo,
Texo Heater & Mfg. Co., Covington, Ky.

HEATING SYSTEMS, VACUUM

Barnes & Jones, Boston, Mass.
Bishop & Babcock Sales Co., Cleveland, Ohio.
Dunham Co., C. A., Chicago, Ill.
Wm. S. Haines & Co., Philadelphia, Pa.
Hoffman Specialty Co., New York.
Illinois Engineering Co., Chicago Ill.
McAlear Mfg. Co., Chicago, Ill
Marsh & Co., Jas. P., Chicago, Ill.
Sarco Co., Inc., New York.
Sterling Engineering Co., Milwaukee, Wis.
Trane Co., The, LaCrosse, Wis.
Webster & Co., Warren, Camden, N. J.

HEATING SYSTEMS, VAPOR

American District Steam Co., North Tonawanda, N. Y.
Barnes & Jones, Boston, Mass.
Bishop & Babcock Sales Co., Cleveland, Ohio.
Dunham Co., C. A., Chicago, Ill.
Gorton Heating Corporation, New York
Wm. S. Haines & Co., Philadelphia, Pa.
Hoffman Specialty Co., New York.
Illinois Engineering Co., Chicago, Ill.
Marsh & Co., Jas. P., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
Page Boiler Co., Wm. H., New York.
Sarco Co., Inc., New York.
Simplex Heating Specialty Co., Inc., Lynchburg, Va.
Sterling Engineering Co., Milwaukee, Wis.
Trane Co., The, LaCrosse, Wis.
Vapor Engineering Co., New York.
Webster & Co., Warren, Camden, N. J

HEATING SYSTEMS, WATER

American Radiator Co., Buffalo, N. Y.
Bishop & Babcock Sales Co., Cleveland, Ohio.
Grinnell Co., Providence, R. I.
Hornung, J. C., Chicago, Ill.
Mueller Co., Decatur, Ill.
Page Boiler Co., Wm. H., New York.
Ross Heater & Mfg. Co., Buffalo, N. Y.
The Stack Heater Co., Boston, Mass.

HUMIDIFIERS

American Blower Co., Detroit, Mich.
Bayley Blower Co., Milwaukee, Wis.
Bishop & Babcock Sales Co., Cleveland, Ohio.
Buffalo Forge Co., Buffalo, N. Y.
Carrier Engineering Corp., Newark, N. J.
General Air Filters Corp., New York.
Grinnell Co., Providence, R. I.
Johnson Service Co., Milwaukee, Wis.
National Air Filter Co., Chicago, Ill.
National Regulator Co., Chicago, Ill.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.
Watts Regulator Co., Lawrence, Mass.
York Heating & Ventilating Corp., Philadelphia, Pa.

HUMIDITY CONTROL

Bayley Blower Co., Milwaukee, Wis.
Bishop & Babcock Sales Co., Cleveland Ohio.
Carrier Engineering Corp., Newark, N. J
Foxboro Co., Inc., The, Foxboro, Mass.
Grinnell Co., Providence, R. I.
Johnson Service Co., Milwaukee, Wis.
National Air Filter Co., Chicago, Ill.
National Regulator Co., Chicago, Ill.
Powers Regulator Co., Chicago, Ill.

INSTRUMENTS, ELECTRIC MEASURING

Bristol Co., The, Waterbury, Conn.

INSTRUMENTS, INDICATING AND RECORDING

Bristol Co., The, Waterbury, Conn.
Foxboro Co., Inc., The, Foxboro, Mass.
Marsh & Co., Jas. P., Chicago, Ill.
Mercoid Corporation, Chicago, Ill.

INSULATION, BOILER, PIPE, ETC.

(See Covering, Boiler, Pipe, etc.)

INSULATION, BUILDING

Celotex Co., Chicago, Ill.
Flax-li-num Insulating Co., St. Paul, Minn.
Insulite Co., Minneapolis, Minn.
Johns-Manville Corp., New York, N. Y.

KETTLES, COPPER

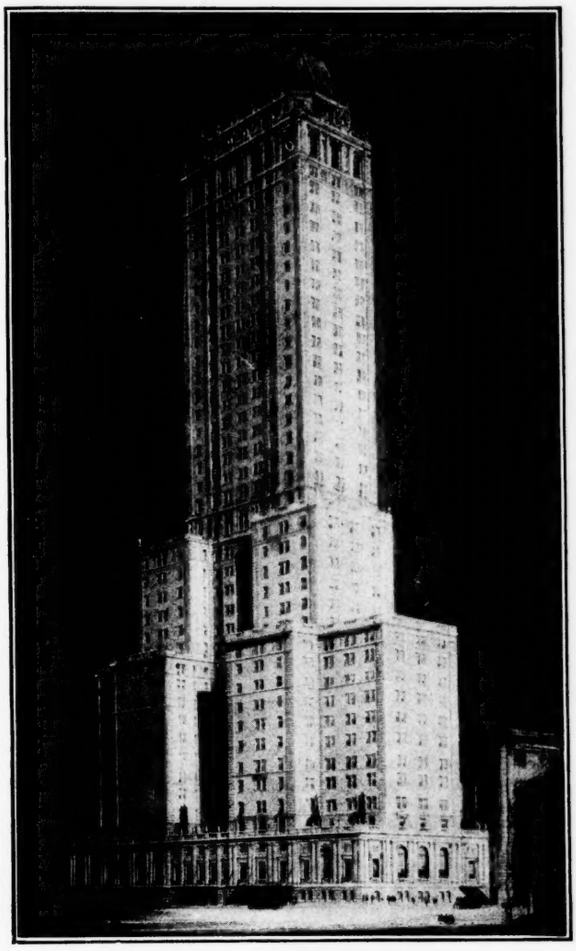
Badger & Sons Co., E. B., Boston, Mass.

MACHINES, PUNCHING AND SHEARING

David H. Smith & Sons Co., Brooklyn, N. Y.

MANOMETERS

American Blower Co., Detroit, Mich
Foxboro Co., Inc., The, Foxboro, Mass



HOTEL PIERRE
5th Ave. and 61st St., New York City.

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Architects

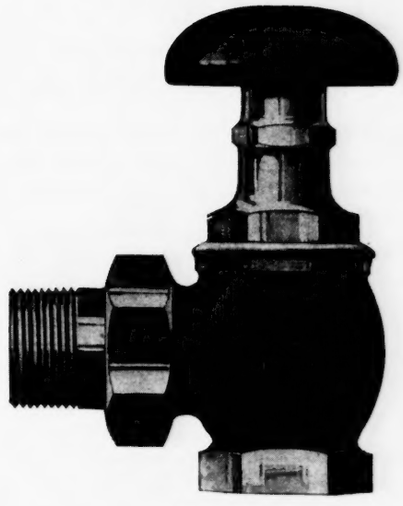
Clyde R. Place
Engineer

George A. Fuller
General Contractor

Baker, Smith & Company
Heating Contractors

MARSH FLAT DISC PACKLESS VALVES

Fig. 133
used throughout on this job



Packless Fig. 133

MARSH VALVE COMPANY

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General Offices: Detroit, Mich.

SARCO COMPANY, Inc.
183 Madison Ave., New York

Taylor-Forbes Company
Canadian Agents Guelph, Ont.

MECHANICAL DRAFT APPLIANCES
(See Draft Appliances, Mechanical)

METALS, THERMOSTATIC
Chace Valve Co., W. M., Detroit, Mich.

METERS, CONDENSATION
American District Steam Co., North Tonawanda, N. Y.
Central Station Steam Co., Detroit, Mich.

METERS, FEED WATER
Central Station Steam Co., Detroit, Mich.

METERS, FLOW
Foxboro Co., Inc., The. Foxboro, Mass.

METERS, PITOT TUBE
American Blower Co., Detroit, Mich.
Buffalo Forge Co., Buffalo, N. Y.

METERS, STEAM
American District Steam Co., North Tonawanda, N. Y.

METERS, WATER, GAS, OIL & AIR
Pittsburgh Equitable Meter Co., Pittsburgh, Pa.

MOTORS (ELECTRIC)
Baldor Electric Co., St. Louis, Mo.
Century Electric Co., St. Louis, Mo.
Emerson Electric Mfg. Co., St. Louis, Mo.
Janette Mfg. Co., Chicago, Ill.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.

NOZZLES, ACID RESISTING
Duriron Co., Inc., The, Dayton, O.

NOZZLES, SPRAY
American Blower Co., Detroit, Mich.
Badger & Sons Co., E. B., Boston, Mass.
Bayley Blower Co., Milwaukee, Wis.
Bishop & Babcock Sales Co., Cleveland, Ohio.
Buffalo Forge Co., Buffalo, N. Y.
Carrier Engineering Corp., Newark, N. J.
Dunham Co., C. A., Chicago, Ill.
Schutte & Koerting Co., Philadelphia, Pa.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.

OIL BURNERS
Electrol Inc., St. Louis, Mo.
Hardinge Bros., Inc., Chicago, Ill.
Johnson Co., S. T., Oakland, Cal.
McIlvaine Burner Corp., Chicago, Ill.
Silent Automatic Corp., Detroit, Mich.

OIL BURNER EQUIPMENT
American Steam Pump Co., Battle Creek, Mich.
Buffalo Forge Co., Buffalo, N. Y.
Hornung, J. C., Chicago, Ill.
Janette Mfg. Co., Chicago, Ill.
Johnston Brothers, Inc., Ferrysburg, Mich.
W. W. Nugent & Co., Chicago, Ill.
Schutte & Koerting Co., Philadelphia, Pa.

OIL BURNER IGNITION AND CONTROL EQUIPMENT
McAlear Mfg. Co., Chicago, Ill.
McDonnell & Miller, Chicago, Ill.
Mercoid Corporation, Chicago, Ill.
Penn Electric Switch Co., Des Moines, Iowa.
Temperature Control Co., Chicago, Ill.
Time-O-Stat Controls Co., Elkhart, Ind.

OZONE APPARATUS
United States Ozone Co. of America, Scottdale, Pa.

PIPE, ACID-RESISTING
Duriron Co., Inc., The, Dayton, O.

PIPE BENDING
Badger & Sons Co., E. B., Boston, Mass.
Crane Co., Chicago, Ill.
Grinnell Co., Providence, R. I.
Walworth Co., New York.
Whitlock Coil Pipe Co., Hartford, Conn.

PIPE CASING (WOOD)
American District Steam Co., North Tonawanda, N. Y.

PIPE, CAST-IRON
American Radiator Co., New York.

PIPE HANGERS
Crane Co., Chicago, Ill.
Grinnell Co., Providence, R. I.
Walworth Co., New York.

PIPE THREADING & CUTTING MACHINES
Crane Co., Chicago, Ill.

PIPE, STEEL
Crane Co., Chicago, Ill.
National Tube Co., Pittsburgh, Pa.

PRESSURE REDUCING VALVES
(See Regulators, Pressure).

PULLEYS, VARIABLE SPEED

PUMPS, ACID RESISTING
Duriron Co., Inc., The, Dayton, O.

PUMPS, CENTRIFUGAL
American Steam Pump Co., Battle Creek, Mich.
Chicago Pump Co., Chicago, Ill.
Dunham Co., C. A., Chicago, Ill.
Foster Wheeler Corp., New York.
Nash Engineering Co., So. Norwalk, Conn.
Trane Co., The, LaCrosse, Wis.

PUMPS, CENTRIFUGAL, VACUUM HEATING
Ames Pump Co., New York.
Chicago Pump Co., Chicago, Ill.
Dunham Co., C. A., Chicago, Ill.
Nash Engineering Co., So. Norwalk, Conn.
Skidmore Corp., Chicago, Ill.
Trane Co., The, LaCrosse, Wis,

PUMPS, CONDENSATION
Ames Pump Co., New York.
Buffalo Steam Pump Co., Buffalo, N. Y.
Chicago Pump Co., Chicago, Ill.
Dunham Co., C. A., Chicago, Ill.
Nash Engineering Co., So. Norwalk, Conn.
Skidmore Corp., Chicago, Ill.
Sterling Engineering Co., Milwaukee, Wis.
Trane Co., The, LaCrosse, Wis.

PUMPS, OIL
Janette Mfg. Co., Chicago, Ill.
Nugent & Co., W. W., Chicago, Ill.

PUMPS, RECIPROCATING STEAM
American Steam Pump Co., Battle Creek, Mich.
Buffalo Steam Pump Co., Buffalo, N. Y.

PUMPS, SUMP
Chicago Pump Co., Chicago, Ill.
Janette Mfg. Co., Chicago, Ill.
Nash Engineering Co., So. Norwalk, Conn.

PUMPS, TURBINE
Ames Pump Co., New York.
Foster Wheeler Corp., New York.
Nash Engineering Co., So. Norwalk, Conn.

PUMPS, VACUUM
Ames Pump Co., New York.
Chicago Pump Co., Chicago, Ill.
Dunham Co., C. A., Chicago, Ill.
Foster Wheeler Corp., New York.
Janette Mfg. Co., Chicago, Ill.
Nash Engineering Co., So. Norwalk, Conn.
Skidmore Corp., Chicago, Ill.
Trane Co., The, LaCrosse, Wis.

RADIATION, LIGHT WEIGHT, NON FERROUS
American Radiator Co., New York.
McQuay Radiator Co., Chicago, Ill.
The Herman Nelson Corp., Moline, Ill.
Rome Brass Radiator Corp., New York.
Rome Turney Radiator Co., Rome, N. Y.
Thermal Units Co., Chicago, Ill.
Trane Co., The, La Crosse, Wis.
Winchester Repeating Arms Co., New Haven, Conn.
Young Radiator Co., Racine, Wis.

RADIATOR ENCLOSURES AND SHIELDS
McQuay Radiator Corp., Chicago, Ill.
Schleicher Inc., Gary, Ind.

RADIATOR HANGERS
American Radiator Co., Buffalo, N. Y.
Grinnell Co., Providence, R. I.
Hartmann Co., Charles, Brooklyn, N. Y.
Healy-Ruff Co., St. Paul, Minn.
Kewanee Boiler Corp., Kewanee, Ill.
McAlear Mfg. Co., Chicago, Ill.

RADIATOR TUBES, COPPER
Wolverine Tube Co., Detroit, Mich.

RADIATORS, CABINET AND CONCEALED
Air-Way Electric Appliance Corp., Toledo, Ohio.
Fintube Radiator Co., Long Island City, N. Y.
McQuay Radiator Corp., Chicago, Ill.
Modine Mfg. Co., Racine, Wis.
Nelson Corp., Herman, The, Moline, Ill.
Reed Air Filter Co., Inc., Louisville, Ky.
Rome Brass Radiator Corp., New York.
Thermal Units Co., Chicago, Ill.
Trane Co., The, LaCrosse, Wis.
Young Radiator Co., Racine, Wis.

RADIATORS, CAST-IRON
American Radiator Co., Buffalo, N. Y.
Burnham Boiler Corp., Irvington, N. Y.
Crane Co., Chicago, Ill.
Kewanee Boiler Corp., Kewanee, Ill.
Modine Mfg. Co., Racine, Wis.
National Radiator Corp., Johnstown, Pa.
Nelson Corp., Herman, The, Moline, Ill.
Page Boiler Co., Wm. H., New York.

RADIATORS, GAS FIRED
Automatic Gas Steam Radiator, Pittsburgh, Pa.

RADIATORS, VERTICAL FIN
Wolverine Tube Co., Detroit, Mich.

RECEIVERS, AIR
Brownell Co., The, Dayton, Ohio.
Frost Mfg. Co., Galesburg, Ill.
Vapor Engineering Co., New York.
Whitlock Coil Pipe Co., Hartford, Conn.

RECEIVERS, CONDENSATION
American District Steam Co., North Tonawanda, N. Y.
Crane Co., Chicago, Ill.
Dunham Co., C. A., Chicago, Ill.
Illinois Engineering Co., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
The Stack Heater Co., Boston, Mass.
Trane Co., The, LaCrosse, Wis.
Vapor Engineering Co., New York.
Whitlock Coil Pipe Co., Hartford, Conn.

REFRIGERATING APPARATUS
Vilter Mfg. Co., Milwaukee, Wis.

REGULATORS, BOILER-FEED
Atlas Valve Co., Newark, N. J.
Kieley & Mueller, Inc., New York.
McAlear Mfg. Co., Chicago, Ill.
McDonnell & Miller, Chicago, Ill.
The Stack Heater Co., Boston, Mass.
Watts Regulator Co., Lawrence, Mass.

REGULATORS, DAMPER
American District Steam Co., North Tonawanda, N. Y.
American Radiator Co., Buffalo, N. Y.
Atlas Valve Co., Newark, N. J.
Dunham Co., C. A., Chicago, Ill.
Gorton Heating Corp., New York.
Hoffman Specialty Co., New York.
Illinois Engineering Co., Chicago, Ill.
Johnson Service Co., Milwaukee, Wis.
Kieley & Mueller, Inc., New York.
McAlear Mfg. Co., Chicgao, Ill.
Marsh & Co., Jas. P., Chicago, Ill.
National Regulator Co., Chicago, Ill.
Page Boiler Co., Wm. H., New York.
Powers Regulator Co., Chicago, Ill.
Sarco Co., Inc., New York.
Simplex Heating Specialty Co., Inc., Lynchburg, Va.
The Stack Heater Co., Boston, Mass.
Sterling Engineering Co., Milwaukee, Wis.
Trane Co., The, LaCrosse, Wis.
Watts Regulator Co., Lawrence, Mass.
White Mfg. Co., St. Paul, Minn.

REGULATORS, GAS
Pittsburgh Equitable Meter Co., Pittsburgh, Pa.

REGULATORS, PRESSURE
American District Steam Co., North Tonawanda, N. Y.
Atlas Valve Co., Newark, N. J.
Bishop & Babcock Sales Co., Cleveland, Ohio.
Bristol Co., The, Waterbury, Conn.
Crane Co., Chicago, Ill.
Dunham Co., C. A., Chicago, Ill.
Hornung, J. C., Chicago, Ill.
Illinois Engineering Co., Chicago, Ill.
Jenkins Bros., New York.
Johnson Service Co., Milwaukee, Wis.
Kainer & Company, Chicago, Ill.
Kieley & Mueller, Inc., New York.
Lytton Mfg. Corp., Franklin, Va.
McAlear Mfg. Co., Chicago, Ill.
Marsh & Co., Jas. P., Chicago, Ill.
Mueller Co., Decatur, Ill.
National Regulator Co., Chicago, Ill.
O-E Specialty Mfg. Co., Milwaukee, Wis.
Pittsburgh Equitable Meter Co., Pittsburgh, Pa.
Powers Regulator Co., Chicago, Ill.
Schutte & Koerting Co., Philadelphia, Pa
The Stack Heater Co., Boston, Mass.
Watts Regulator Co., Lawrence, Mass.

REGULATORS, TEMPERATURE
(See Temperature Control)

REGULATOR, WATER
Pittsburgh Equitable Meter Co., Pittsburgh, Pa.

SEPARATORS, OIL
Bishop & Babcock Sales Co., Cleveland, Ohio.
Crane Co., Chicago, Ill.
Illinois Engineering Co., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
Patterson-Kelley Co., New York.
Schutte & Koerting Co., Philadelphia, Pa.
Webster & Co., Warren, Camden, N. J.

SEPARATORS, STEAM
American District Steam Co., North Tonawanda, N. Y.
Bishop & Babcock Sales Co., Cleveland, Ohio.
Crane Co., Chicago, Ill.
Illinois Engineering Co., Chicago, Ill.
Swartwout Co., Cleveland, Ohio.
Webster & Co., Warren, Camden, N. J.

SPRAY COOLING SYSTEMS
Badger & Sons Co., E. B., Boston, Mass.
Bayley Blower Co., Milwaukee, Wis.
Bishop & Babcock Sales Co., Cleveland, Ohio.
Buffalo Forge Co., Buffalo, N. Y.
Schutte & Koerting Co., Philadelphia, Pa.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.

SPRAY NOZZLES
(See Nozzles, Spray)

STERILIZER, WATER
U. S. Ozone Corp., Scottdale, Penn.

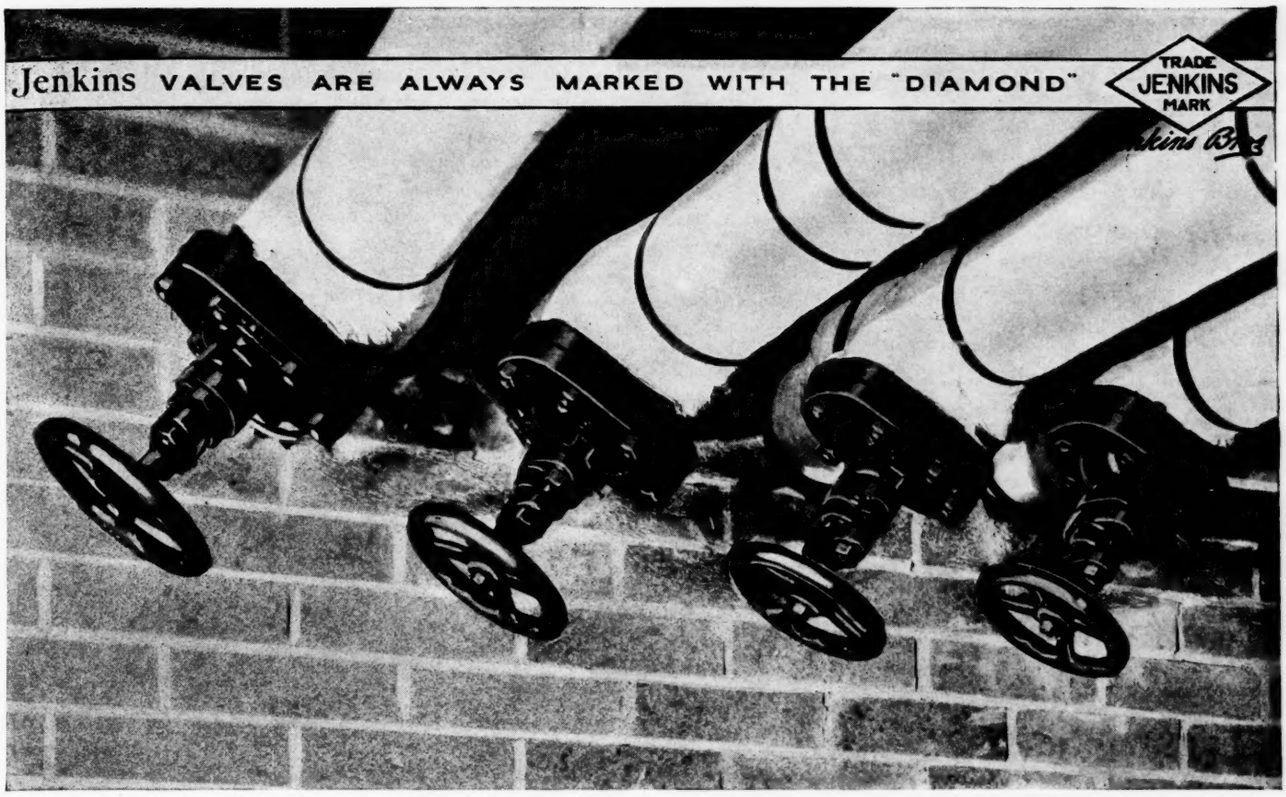
STOKERS, MECHANICAL
Brownell Co., Dayton, Ohio.
Domestic Stoker Co., New York.
General Stoker Corp., New York.

STRAINERS, OIL
Bishop & Babcock Sales Co., Cleveland, Ohio.
Dunham Co., C. A., Chicago, Ill.
Illinois Engineering Co., Chicago, Ill.
Janette Mfg. Co., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
Nugent & Co., W. W., Chicago, Ill.
Pittsburgh Equitable Meter Co., Pittsburgh, Pa.
Sarco Co., Inc., New York.
Schutte & Koerting Co., Philadelphia, Pa.

STRAINERS, STEAM
American District Steam Co., North Tonawanda, N. Y.
Bishop & Babcock Sales Co., Cleveland, Ohio.
Illinois Engineering Co., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
Sarco Co., Inc., New York.
Schutte & Koerting Co., Philadelphia, Pa.

STRAINERS, WATER
Dunham Co., C. A., Chicago, Ill.
Illinois Engineering Co., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
Pittsburgh Equitable Meter Co., Pittsburgh, Pa.
Ross Heater & Mfg. Co., Buffalo, N. Y.
Sarco Co., Inc., New York.
Schutte & Koerting Co., Philadelphia, Pa.
Watts Regulator Co., Lawrence, Mass.

TEMPERATURE CONTROL
American Radiator Co., Buffalo, N. Y.
Atlas Valve Co., Newark, N. J.
Bishop & Babcock Sales Co., Cleveland, Ohio.
Bristol Co., The, Waterbury, Conn.
Carrier Engineering Corp., Newark, N. J
Foxboro Co., Inc., The, Foxboro, Mass.
Fulton Sylphon Co., Knoxville, Tenn.
Hornung, J. C., Chicago, Ill.
Illinois Engineering Co., Chicago, Ill.
Kieley & Mueller, Inc., New York.
Marsh & Co., Jas. P., Chicago, Ill.
Mercoid Corporation, Chicago, Ill.
Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.
National Regulator Co., Chicago, Ill.
Powers Regulator Co., Chicago, Ill.
Penn Electric Switch Co., Des Moines.
Raymond, F. I., Chicago, Ill.
Sarco Co., Inc., New York.
Sheer Co., H. M., Quincy, Ill.
The Stack Heater Co., Boston, Mass.
Stat-Amatic Instrument & Appliance Co., Hartford, Conn.
Sterling Engineering Co., Milwaukee, Wis.
Time-O-Stat Controls Co., Elkhart, Ind.
Trane Co., The, LaCrosse, Wis.
Watts Regulator Co., Lawrence, Mass.
White Mfg. Co., St. Paul, Minn.



Four Fig. 325, Jenkins Standard Iron Body Gate Valves, screwed, in steam piping, Whitcomb Hotel, St. Joseph, Mich.

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Good workmanship, good piping, Jenkins Valves .... total the three and the result is invariably the same. They are factors making for all round satisfaction .... satisfaction over plumbing or heating that is lastingly efficient.

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THERMOMETERS, RECORDING AND INDICATING

American Radiator Co., Buffalo, N. Y.
Bristol Co., The Waterbury, Conn.
Foxboro Co., Inc., The, Foxboro, Mass.
Marsh & Co., Jas. P., Chicago, Ill.
National Radiator Corp., Johnstown, Pa.
Powers Regulator Co., Chicago, Ill.

THERMOSTATIC METAL

W. M. Chace Valve Co., Detroit, Mich.

THERMOSTATS

Bishop & Babcock Sales Co., Cleveland, Ohio.
Bristol Co., The, Waterbury, Conn.
Marsh & Co., Jas. P., Chicago, Ill.
Mercoid Corporation, Chicago, Ill
Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.
Modine Mfg. Co., Racine, Wis.
National Regulator Co., Chicago, Ill.
Powers Regulator Co., Chicago, Ill.
Sarco Co., Inc., New York.
Stat-Amatic Instrument & Appliance Co., Hartford, Conn.
Time-O-Stat Controls Co., Elkhart, Ind.

TRAPS, BUCKET

Crane Co., Chicago, Ill.
Marsh & Co., Jas. P., Chicago, Ill.
Swartwout Co., Cleveland, Ohio.

TRAPS, FLOAT

Crane Co., Chicago, Ill.
Marsh & Co., Jas. P., Chicago, Ill.
Sarco Co., Inc., New York.
Swartwout Co., Cleveland, Ohio.

TRAPS, FLOAT & THERMOSTATIC

Dunham Co., C. A., Chicago, Ill
Marsh & Co., Jas. P., Chicago, Ill.
Sarco Co., Inc., New York, N. Y.

TRAPS, INVERTED BUCKET (STEAM AND AIR)

Armstrong Machine Wks., Three Rivers, Mich.

TRAPS, LIFTING

Crane Co., Chicago, Ill.
Lytton Mfg. Corp., Franklin, Va.
Swartwout Co., Cleveland, Ohio.

TRAPS, RADIATOR

American District Steam Co., North Tonawanda, N. Y.
Armstrong Machine Wks., Three Rivers, Mich.
Barnes & Jones, Boston, Mass.
Bishop & Babcock Sales Co., Cleveland, Ohio.
Crane Co., Chicago, Ill.
Dunham Co., C. A., Chicago, Ill.
Haines & Co., Wm. S., Philadelphia, Pa.
Hoffman Specialty Co., New York.
Illinois Engineering Co., Chicago, Ill.
Jenkins Bros. New York.
Johns-Manville Corp., New York, N. Y.
Marsh & Co., Jas. P., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
National Radiator Corp., Johnstown, Pa.
Sarco Co., Inc., New York.
Sterling Engineering Co., Milwaukee, Wis.
Trane Co., The, LaCrosse, Wis.
Vapor Engineering Co., New York City.
Webster & Co., Warren, Camden, N. J.

TRAPS, RETURN

American Blower Co., Detroit, Mich.
American District Steam Co., North Tonawanda, N. Y.
Bishop & Babcock Sales Co., Cleveland, Ohio.
Crane Co., Chicago, Ill.
Dunham Co., C. A., Chicago, Ill.
Illinois Engineering Co., Chicago, Ill
Johns-Manville Corp., New York, N. Y.
Kieley & Mueller, Inc., New York.
Lytton Mfg. Corp., Franklin, Va.
Marsh & Co., Jas. P., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
Sarco Co., Inc., New York.
Simplex Heating Specialty Co., Inc., Lynchburg, Va.
Sterling Engineering Co., Milwaukee, Wis.
Swartwout Co., Cleveland, Ohio.
Trane Co., The, LaCrosse, Wis.
Webster & Co., Warren, Camden, N. J.

TRAPS, STEAM

American Blower Co., Detroit, Mich.
American District Steam Co., North Tonawanda, N. Y.
Barnes & Jones, Boston, Mass.
Bishop & Babcock Sales Co., Cleveland, Ohio.
Connor Co., Inc., The W. B., New York.
Crane Co., Chicago, Ill.
Davis Engineering Corp., New York.
Dunham Co., C. A., Chicago, Ill.
Wm. S. Haines & Co., Philadelphia, Pa.
Hoffman Specialty Co., New York.
Illinois Engineering Co., Chicago, Ill.
Johns-Manville Corp., New York, N. Y.
Kieley & Mueller, Inc., New York.
Lytton Mfg. Corp., Franklin, Va.
Marsh & Co., Jas. P., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
Powers Regulator Co., Chicago, Ill
Sarco Co., Inc., New York.

TRAPS, VACUUM

American Blower Co., Detroit, Mich.
Barnes & Jones, Boston, Mass.
Bishop & Babcock Sales Co., Cleveland, Ohio.
Crane Co., Chicago, Ill.
Dunham Co., C. A., Chicago, Ill.
Wm. S. Haines & Co., Philadelphia, Pa.
Hoffman Specialty Co., New York.
Illinois Engineering Co., Chicago, Ill.
Lytton Mfg. Corp., Franklin, Va.
Marsh & Co., Jas. P., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
Sarco Co., Inc., New York.
Schutte & Koerting Co., Philadelphia, Pa.
Sterling Engineering Co., Milwaukee, Wis.
Swartwout Co., Cleveland, Ohio.
Trane Co., The, LaCrosse, Wis.
Webster & Co., Warren, Camden, N. J.

TUBING, COPPER AND BRASS

Crane Co., Chicago, Ill.

TUBING, SEAMLESS, COPPER, BRASS AND ALUMINUM

Wolverine Tube Co., Detroit, Mich.

TURBINES, STEAM

Sturtevant Co., B. F., Hyde Park, Boston, Mass.
Wing Mfg. Co., L. J., New York.

TURBO-BLOWERS

Bayley Blower Co., Milwaukee, Wis.
Buffalo Forge Co., Buffalo, N. Y.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.
Wing Mfg. Co., L. J., New York.

UNIT HEATERS

(See Heaters, Unit)

VACUUM CLEANING APPARATUS

American Radiator Co., Buffalo, N. Y.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.

VALVES, ACID RESISTING

Crane Co., Chicago, Ill.
Duriron Co., Inc., The, Dayton, O.

VALVES, AIR, AUTOMATIC

American Radiator Co., Buffalo, N. Y.
Bishop & Babcock Sales Co., Cleveland, Ohio.
Crane Co., Chicago, Ill.
Dunham Co., C. A., Chicago, Ill.
Fulton Sylphon Co., Knoxville, Tenn.
Gorton Heating Corp., New York.
Hoffman Specialty Co., New York.
Jenkins Bros., New York.
Kelly Brass Works, Chicago, Ill.
Marsh & Co., Jas. P., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
National Radiator Corp., Johnstown, Pa.
National Regulator Co., Chicago, Ill.
Page Boiler Co., Wm., H., New York
Powers Regulator Co., Chicago, Ill.

VALVES, AIR RELIEF

American Radiator Co., Buffalo, N. Y.
Barnes & Jones, Boston, Mass.
Bishop & Babcock Sales Co., Cleveland, Ohio.
Crane Co., Chicago, Ill.
Gorton Heating Corp., New York.
McAlear Mfg. Co., Chicago, Ill.
Marsh & Co., Jas. P., Chicago, Ill.
National Radiator Corp., Johnstown Pa.
Pittsburgh Equitable Meter Co., Pittsburgh, Pa.
Sarco Co., Inc., New York.
The Stack Heater Co., Boston, Mass.
Trane Co., The, LaCrosse, Wis.

VALVES, BACK PRESSURE

Crane Co., Chicago, Ill.
Illinois Engineering Co., Chicago, Ill.
Illinois Malleable Iron Co., Chicago, Ill.
Jenkins Bros., New York.
Kieley & Mueller, Inc., New York.
McAlear Mfg. Co., Chicago, Ill.
Pittsburgh Equitable Meter Co., Pittsburgh, Pa.
Schutte & Koerting Co., Philadelphia, Pa.
Walworth Co., New York.

VALVES, BALANCED

Crane Co., Chicago, Ill.
Illinois Engineering Co., Chicago, Ill.
Jenkins Bros., New York.
Kieley & Mueller, Inc., New York.
McAlear Mfg. Co., Chicago, Ill.
Powers Regulator Co., Chicago, Ill.
Schutte & Koerting Co., Philadelphia, Pa.
Watts Regulator Co., Lawrence, Mass.

VALVES, BLOW-OFF

Crane Co., Chicago, Ill.
Jenkins Bros., New York.
Lytton Mfg. Corp., Franklin, Va.
National Radiator Corp., Johnstown, Pa.
Pittsburgh Equitable Meter Co., Pittsburgh, Pa.
Walworth Co., New York.

VALVES, CHECK

Crane Co., Chicago, Ill.
Dunham Co., C. A., Chicago, Ill.
Grinnell Co., Providence, R. I.
Illinois Malleable Iron Co., Chicago, Ill.
Jenkins Bros., New York.
Schutte & Koerting Co., Philadelphia, Pa.
Walworth Co., New York.

VALVES, DIFFERENTIAL RELIEF, GAS

Pittsburgh Equitable Meter Co., Pittsburgh, Pa.

VALVES, FLOAT

Atlas Valve Co., Newark, N. J.
Crane Co., Chicago, Ill.
Dunham Co., C. A., Chicago, Ill.
Grinnell Co., Providence, R. I.
Illinois Engineering Co., Chicago, Ill.
Kieley & Mueller, Inc., New York.
McAlear Mfg. Co., Chicago, Ill.
Marsh & Co., Jas. P., Chicago, Ill.
National Radiator Corp., Johnstown, Pa.
Schutte & Koerting Co., Philadelphia, Pa.
Time-O-Stat Controls Co., Elkhart, Ind.
Watts Regulator Co., Lawrence, Mass.

VALVES, GATE

American District Steam Co., North Tonawanda, N. Y.
Crane Co., Chicago, Ill.
Grinnell Co., Providence, R. I.
Illinois Malleable Iron Co., Chicago, Ill.
Jenkins Bros., New York.
Marsh Valve Co., Dunkirk, N. Y.
National Radiator Corp., Johnstown, Pa.
Walworth Co., New York.

VALVES, GLOBE, ANGLE & CROSS

Crane Co., Chicago, Ill.
Grinnell Co., Providence, R. I.
Illinois Malleable Iron Co., Chicago, Ill.
Jenkins Bros., New York.
Marsh Valve Co., Dunkirk, N. Y.
National Radiator Corp., Johnstown, Pa.
Powers Regulator Co., Chicago, Ill.
Schutte & Koerting Co., Philadelphia, Pa.
Walworth Co., New York.

VALVES, HYDRAULIC-OPERATING

Crane Co., Chicago, Ill.
Jenkins Bros., New York.
Kieley & Mueller, Inc., New York.
Walworth Co., New York.

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Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.
Time-O-Stat Controls Co., Elkhart, Ind.

VALVES, NON BY-PASS

The Stack Heater Co., Boston, Mass.

VALVES, NON-RETURN

Crane Co., Chicago, Ill.
Dunham Co., C. A., Chicago, Ill.
Grinnell Co., Providence, R. I.
Illinois Engineering Co., Chicago, Ill.
Jenkins Bros., New York.
Kieley & Mueller, Inc., New York.
McAlear Mfg. Co., Chicago, Ill.
National Radiator Corp., Johnstown, Pa.
Walworth Co., New York.

VALVES, RADIATOR

American District Steam Co., North Tonawanda, N. Y.
American Radiator Co., Buffalo, N. Y.
Barnes & Jones, Boston, Mass.
Bishop & Babcock Sales Co., Cleveland, Ohio.
Crane Co., Chicago, Ill.
Dunham Co., C. A., Chicago, Ill.
Gorton Heating Corp., New York.
Wm. S. Haines & Co., Philadelphia, Pa.
Hoffman Specialty Co., New York.
Illinois Engineering Co., Chicago, Ill.
Jenkins Bros., New York.
Marsh & Co., Jas. P., Chicago, Ill.
Marsh Valve Co., Dunkirk, N. Y.
National Radiator Corp., Johnstown, Pa.
National Regulator Co., Chicago, Ill.
Page Boiler Co., Wm. H., New York.
Powers Regulator Co., Chicago, Ill.
Sarco Co., Inc., New York.
Simplex Heating Specialty Co., Inc., Lynchburg, Va.
Sterling Engineering Co., Milwaukee, Wis.
Trane Co., The, LaCrosse, Wis.
Vapor Engineering Co., New York.
Walworth Co., New York.
Webster & Co., Warren, Camden, N. J.

VALVES, PRESSURE REDUCING

(See Regulators, Pressure)

VALVES, REGULATING

Atlas Valve Co., Newark, N. J.
Bishop & Babcock Sales Co., Cleveland, Ohio.
Bristol Co., The, Waterbury, Conn.
Crane Co., Chicago, Ill.
Fulton Sylphon Co., Knoxville, Tenn.
Hornung, J. C., Chicago, Ill.
Illinois Engineering Co., Chicago, Ill.
Jenkins Bros., New York.
Kainer & Co., Chicago, Ill.
Kieley & Mueller, Inc., New York.
McAlear Mfg. Co., Chicago, Ill.
Mueller Co., Decatur, Ill.
Powers Regulator Co., Chicago, Ill.
Sarco Co., Inc., New York.
Walworth Co., New York.

VALVES, RELIEF (WATER)

Crane Co., Chicago, Ill.
Kainer & Co., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
Marsh & Co., Jas. P., Chicago, Ill.
Mueller Co., Decatur, Ill.
National Radiator Corp., Johnstown, Pa.
The Stack Heater Co., Boston, Mass.

VALVES, SAFETY

American District Steam Co., North Tonawanda, N. Y.
American Radiator Co., Buffalo, N. Y.
Crane Co., Chicago, Ill.
Jenkins Bros., New York.
Marsh & Co., Jas. P., Chicago, Ill.
National Radiator Corp., Johnstown, Pa.
Pittsburgh Equitable Meter Co., Pittsburgh, Pa.
The Stack Heater Co., Boston, Mass.
Time-O-Stat Controls Co., Elkhart, Ind.
Walworth Co., New York.

VALVES, STOP AND CHECK

(See Valves, Non-Return).

VALVES, VACUUM RELIEF

The Stack Heater Co., Boston, Mass.
Watts Regulator Co., Lawrence, Mass.

VENTILATING SYSTEMS

American Blower Co., Detroit, Mich.
American Radiator Co., Buffalo, N. Y.
Bayley Blower Co., Milwaukee, Wis.
Bishop & Babcock Sales Co., Cleveland, Ohio.
Buffalo Forge Co., Buffalo, N. Y.
Carrier Engineering Corp., Newark, N. J.
National Regulator Co., Chicago, Ill.
Nelson Corp., Herman, The, Moline, Ill
Skinner Bros. Mfg. Co., St. Louis, Mo.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.
Wing Mfg. Co., L. J., New York.

VENTILATING SYSTEMS, ACID

Duriron Co., Inc., The, Dayton, O.

VENTILATORS

Bayley Blower Co., Milwaukee, Wis.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.

VENTILATORS, FLOOR

Aeolus Dickinson, Chicago, Ill.
American Blower Co., Detroit, Mich.
Buffalo Forge Co., Buffalo, N. Y.
Knowles Mushroom Ventilator Co., New York.
Ventilating Products Co., Chicago, Ill.

VENTILATORS, ROOF

Aeolus Dickinson, Chicago, Ill.

VENTILATORS, UNIT

American Blower Co., Detroit, Mich.
Nelson Corp., Herman, The, Moline, Ill
Peerless Unit Ventilation Co., Inc., Bridgeport, Conn.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.

WATER STERILIZERS

WRENCHES, STILLSON

Walworth Co., New York.

ZONE HEATING SYSTEMS

Illinois Engineering Co., Chicago, Ill.
Marsh & Co., Jas. P., Chicago, Ill.
Webster Talmadge, New York.

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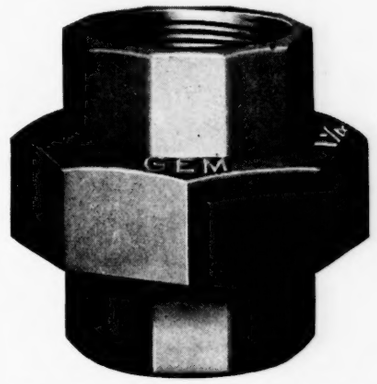
This light, low cost union does the work of heavy gasket type unions



Crane Gem union No. 512 does away with the need of gaskets on pipe lines carrying working pressures up to 150 pounds

In this Gem union No. 512, Crane Co. offers to plumbers and steam fitters a means of increasing both the efficiency and profit in a job.

On all general steam, water, gas, and oil lines carrying pressures up to 150 pounds it can be substituted for gasket type unions with complete assurance of safety. Lighter than the famous Crane Railroad and Navy unions, the Gem is produced by the same exacting process.

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The Gem union is representative of many instances in which Crane engineers have effected real economies in the design of piping materials. For complete information, regarding it; write for Circular No. 220.

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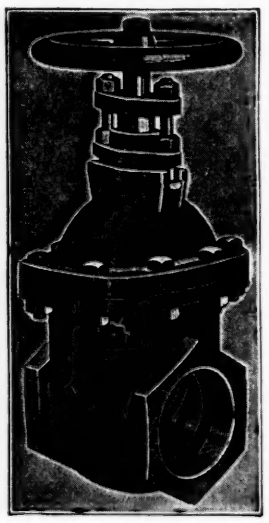
IRON BODY GATE VALVES



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AND
HUB END STYLES

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AND
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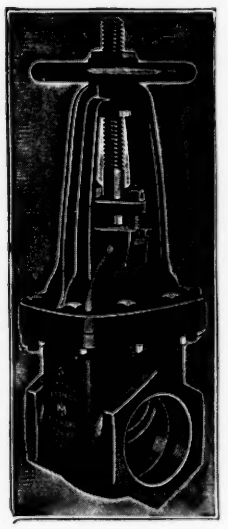

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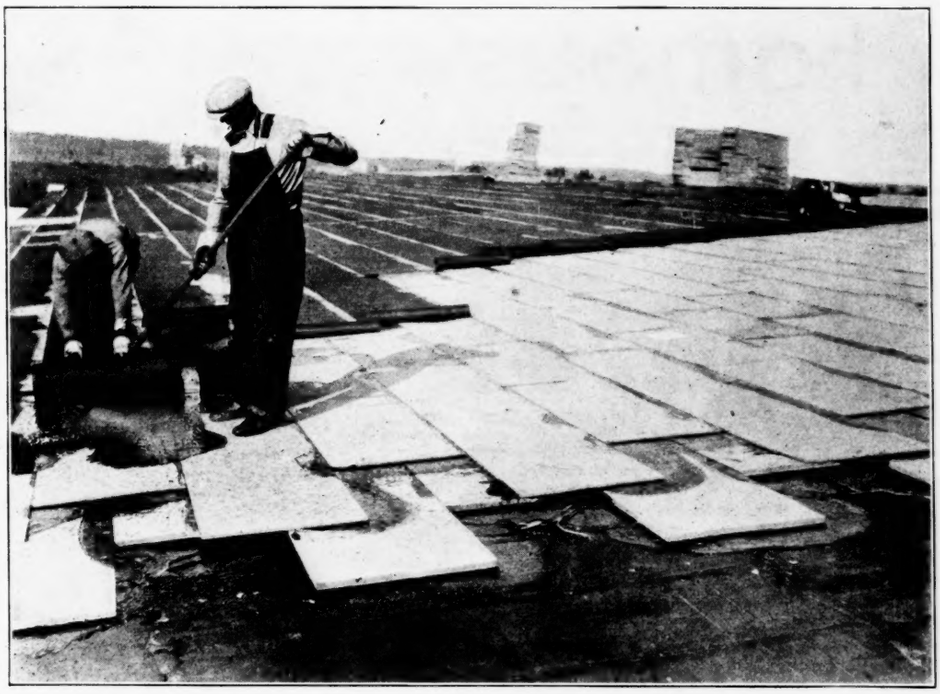

The roof of the National Plate Glass Company plant at Ottawa, Illinois is insulated with Celotex Roof Insulation Board to shut out summer heat and conserve fuel through the winter months. The convenient 2' x 5' units are quickly applied over wood, metal or concrete roof decks, and under any type of built-up covering.

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. . . *meets all practical requirements*

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Mayflower Hotel, Los Angeles
University of California Hospital, San Francisco
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Medical Building, Oakland

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Weil-McLain Boilers *are famous fighters, too!*

The same features that enable Weil-McLain Boilers to fight fuel and heat waste make them good business builders for you. Home owners and builders are quick to understand that these features mean more heat and less fuel burned.

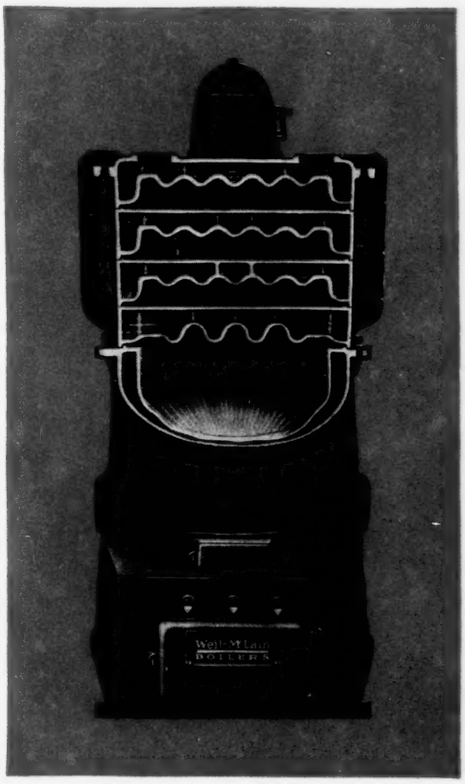
Fuel-saving corrugations like this ∿∿∿

The Weil-McLain Round Boiler, for example, delivers more heat and saves fuel because all the vital heat-absorbing surfaces are corrugated like this ∿∿∿, instead of flat like this ———. You can easily see that the wavy line crowds 30 to 40 per cent more heating surface into the same space.

Balanced back-and-forth fire travel

More heat is actually utilized in Weil-McLain Boilers because Weil-McLain fire travel is not only back and forth but it is *balanced.* Variations in the rate at which boilers operate, due to varying heat demands, do not alter the long, balanced, back-and-forth flow of gases through the flues.

In the complete line of Weil-McLain Boilers you will find many other features—scientific principles of design that enable these boilers to fight fuel waste and deliver more heat. The line includes Round Type, Jacketed, Square, Self-feed and Smokeless Boilers. Also Weil-McLain "Cameo" Radiators.



WEIL-McLAIN COMPANY, General Office: Chicago
Boiler Plant and Offices: Michigan City, Ind.
Radiator Plant and Offices: Erie, Pa.

Jobbing distributors with local stocks in most jobbing centers

Weil-McLain
SCIENTIFIC COMBUSTION
BOILERS

fight fuel waste and deliver more heat

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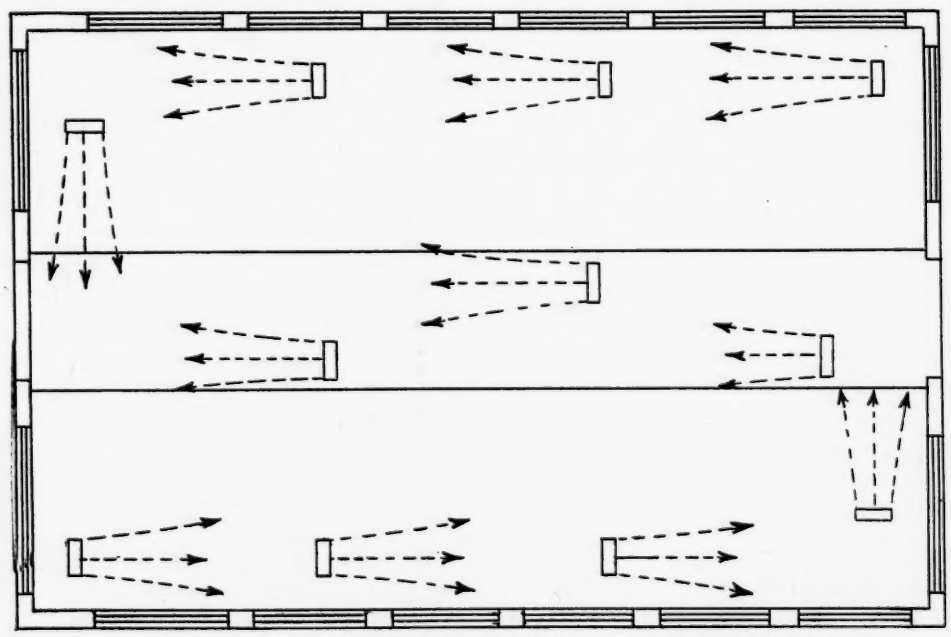
WHEN INDUSTRY SUFFERS FROM COLD FEET . . .

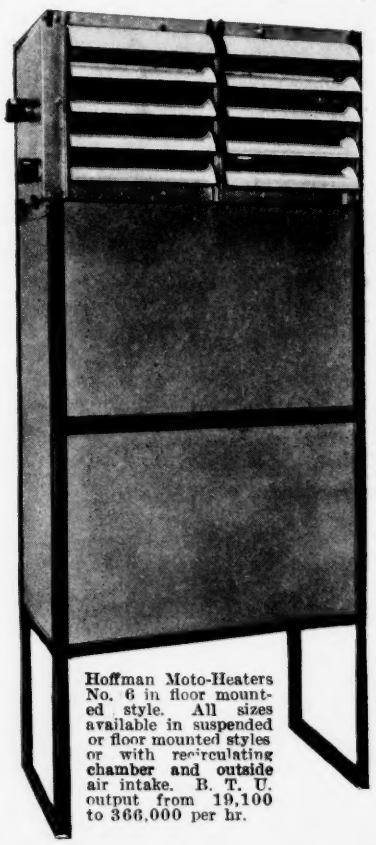
Cold feet is a common complaint in industrial plants that are still heated by old-fashioned methods. Heat is there, to be sure, but not where it is needed. Warm air is banked up under the ceiling, while the lower areas remain cold and uncomfortable. *The heating is upside down.*

Hoffman Moto-Heaters offer heating engineers and contractors a means of correcting upside down heating. For Hoffman Moto-Heaters generate heat over the heads of the workers and distribute it directly to the working zone. Cold floor areas are banished. Drafty corners are eliminated. Fuel bills are reduced. Operating efficiency is improved.

Hoffman Moto-Heaters are made in a complete range of sizes and types for all requirements. For complete technical information on all Hoffman Products send for our 60 page catalog. Hoffman Specialty Company, Inc., Dept. C-60, Waterbury, Conn.



The modern way to heat a typical industrial building with Hoffman Moto-Heaters. Heat is distributed to the working zone throughout the entire building.



Hoffman Moto-Heaters No. 6 in floor mounted style. All sizes available in suspended or floor mounted styles or with recirculating chamber and outside air intake. B. T. U. output from 19,100 to 366,000 per hr.

Outstanding Advantages of Hoffman Moto-Heaters

1—Light in weight.

2—Tested at 1000 pounds per sq. in. hydrostatic pressure.

3—All types guaranteed for working pressures up to 200 lbs.

4—Permanently steam tight joints. Copper tubes fused to welded steel header—no expanded joints.

5—Smooth fins, reducing collection of dirt.

6—Fins embedded in copper tubing, insuring efficient heat transfer.

7—Low in first cost and installation cost.